PowerLogic PM5500 series
User manual

HRB1684301-00

09/2013

Schneider Electric

Contents

Safety information

Important information

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this manual or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a "Danger" or "Warning" safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, can result in death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, can result in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol shall not be used with this signal word.

Please note

Electrical equipment should be installed, operated, serviced and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.

Notices

Class B FCC Part 15

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This Class B digital apparatus complies with Canadian ICES-003.

Reasonable use and responsibility

This product must be installed, connected and used in compliance with prevailing standards and/or installation regulations.

If this product is used in a manner not specified by the manufacturer, the protection provided by the product may be impaired.

The safety of any system incorporating this product is the responsibility of the assembler/installer of the system.

Updates

As standards, specifications and designs change from time to time, always ask for confirmation of the information given in this publication.

Trademarks

PowerLogic and Schneider Electric are trademarks or registered trademarks of Schneider Electric in France, the USA and other countries.

Chapter 1   Introduction

The PowerLogic™ PM5500 series power and energy meters offer value for the demanding needs of your energy monitoring and cost management applications. All meters in the PM5500 series range comply to Class 0.2S accuracy standards and feature high quality, reliability and affordability in a compact and easy to install format.

Some of the many features supported by the meter include:

- A fourth current input for direct and accurate measurement of neutral current, to help avoid device overload and network outage.
- Two digital outputs for control and energy pulsing applications.
- Four digital inputs with input metering support for WAGES monitoring applications.
- Dual Ethernet switched ports allow fast Ethernet interconnection to other PM5500 series meters using only one IP switch.
- Multiple tariff support (8 tariffs) for monitoring energy usage on different days and times.
- Extensive alarming options, including logic and custom alarms.
- THD and individual harmonics up to the 63rd order.
- Onboard webpages for displaying real-time and logged data using a web browser.
- Onboard data logging support for up to 14 selectable parameters.
- Multiple language support: The back-lit anti-glare display screen can be switched to display meter information in one of the supported languages (available with integrated display model).
- Graphical display of harmonics and phasor diagrams (available with integrated display model).

You can use the meter can as a stand-alone device, but its extensive capabilities are fully realized when used as part of an energy management system.

For applications, feature details and the most current and complete specifications of the PM5500 series meters, see the PM5000 series technical datasheet at www.schneider-electric.com.

PM5500 series meter models

The PM5500 series is available in the following models and mounting options:

Model	Commercial reference	Description
PM5560	METSEPM5560	Front panel mount, integrated display, 96 x 96 mm form factor, fits in a 1/4 DIN mounting hole.
PM5563	METSEPM5563	Transducer (TRAN) model, no display, mounts on a standard TS35 top hat style DIN rail.

Measured parameters

The meter provides fully bi-directional, 4-quadrant, Class 0.2S accurate energy metering. This section lists some of the parameters measured by the meter.

Energy

The meter stores all accumulated active, reactive and apparent energy parameters in nonvolatile memory:

- kWh, kVARh, kVAh delivered and received
- kWh, kVARh, kVAh net (delivered - received)
- kWh, kVARh, kVAh absolute (delivered + received)

Energy registers can be logged automatically on a programmed schedule. All energy parameters represent the total for all three phases.

Demand

The meter supports standard demand calculation methods, including sliding block, fixed block, rolling block, thermal and synchronized.

The meter provides present, last, predicted and peak (maximum) demand, and a date/timestamp when the peak demand occurred. Peak demand registers can be reset manually (password protected) or logged and reset automatically on a programmed schedule.

Demand measurements include:

- kW, kVAR, kVA demand
- Amps (average) demand
- Demand calculation for pulse input metering (WAGES)

Instantaneous

The meter provides highly accurate 1-second measurements, including true RMS, per phase and total for:

- 3-phase voltage (line-to-line, line-to-neutral)
- 3-phase current, neutral and ground current
- Active (kW), reactive (kVAR) and apparent (kVA) power
- True PF (power factor)
- Displacement PF
- System frequency
- Voltage (line-to-line, line-to-neutral) and current unbalance

Power quality

The meter provides complete harmonic distortion metering, recording and real-time reporting, up to the 63rd harmonic for all voltage and current inputs.

- Individual harmonics (odd harmonics up to 63rd)
- Total harmonic distortion (THD, thd) for current and voltage (line-to-line, line-to-neutral)
- Total demand distortion (TDD)
- K-factor, Crest factor
- Neutral current metering and ground current calculation

Data recording

The meter records the following:

- Each new minimum and new maximum value with date and timestamp for all instantaneous values and for each phase
- Alarms (with 1s timestamping)
- Parameters configured for data logging
- Maintenance, alarm and event logs

Input/Output

The meter provides the status of the digital inputs and digital outputs.

Other measurements

The meter also provides the following measurements:

- I/O timer shows how long an input or output has been ON.
- Operating timer shows how long a load has been powered.
- Load timer shows how much time a load has been running, based on the specified minimum current for the load timer setpoint setting.

Data display and analysis tools

The meter integrates seamlessly with display and analysis software available from Schneider Electric™ such as StruxureWare™ Power Monitoring Expert and StruxureWare™ PowerSCADA Expert.

Power Monitoring Expert software lets you analyze and monitor your system and produce reports for any department in an organization. Power Monitoring Expert is designed to make use of all the meter's available advanced capabilities. You can also use data acquired by the meter in a variety of third-party systems.

PowerSCADA Expert lets you control your system with high reliability, performance and data integrity. PowerSCADA Expert is designed to help reduce outages and increase power efficiency. It is built to handle simple to complex user requirements.

Related topics

- See the Power Monitoring Expert and PowerSCADA Expert product pages at www.schneider-electric.com for more information.

Meter configuration

Meter configuration is performed through the display panel (if your meter equipped with it) or through PowerLogic™ ION Setup. ION Setup is a meter configuration tool that can be downloaded for free at www.schneider-electric.com.

Related topics

- See the "PM5500 series" topic in the ION Setup online help or in the *ION Setup device configuration guide*. To download a copy, go to www.schneider-electric.com and search for ION Setup device configuration guide.

Firmware

This user manual is written to be used with meter firmware 1.01 or later. See "Firmware version, model and serial number" on page 126 to view your meter's firmware version.

Meter display language

If your meter is equipped with a display screen, you can configure the meter to display the measurements in one of the following languages:

- English
- French
- Spanish
- German
- Italian
- Portuguese
- Russian
- Chinese

See "Setting up regional settings" on page 44 to change the displayed language and other regional settings.

Chapter 2   Hardware reference

This section supplements the meter's installation sheet and provides additional information about the meter's physical characteristics and capabilities.

Related topics
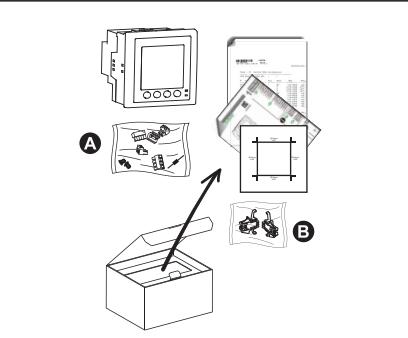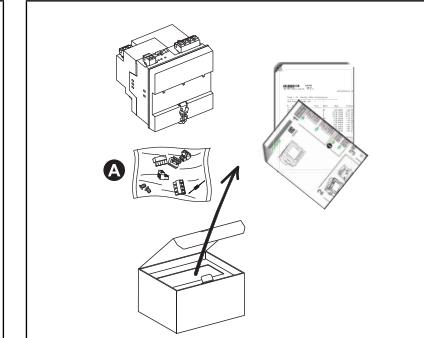
- See "Specifications" on page 28 for detailed meter specifications.
- See "Introduction" on page 11 for a description of features supported by your meter.
- See your product's technical datasheet at www.schneider-electric.com for the most current and complete specifications.

Meter models

The meter is available in these models:

- PM5560: panel-mount meter with integrated display, fits in a 1/4 DIN panel cutout.
- PM5563: DIN rail mount meter with no display.

PM5500 series meter models and supplied hardware

PM5560			PM5563	
Ⓐ	Connector kit		**Ⓐ**	Connector kit
Ⓑ	Mounting hardware			

LED indicators

The LED indicators alert or inform you of meter activity.

Location of LEDs

	PM5560	PM5563	A	Alarm / energy pulsing LED
			B	Heartbeat / serial communications LED

All meter models	C	Ethernet communications LEDs
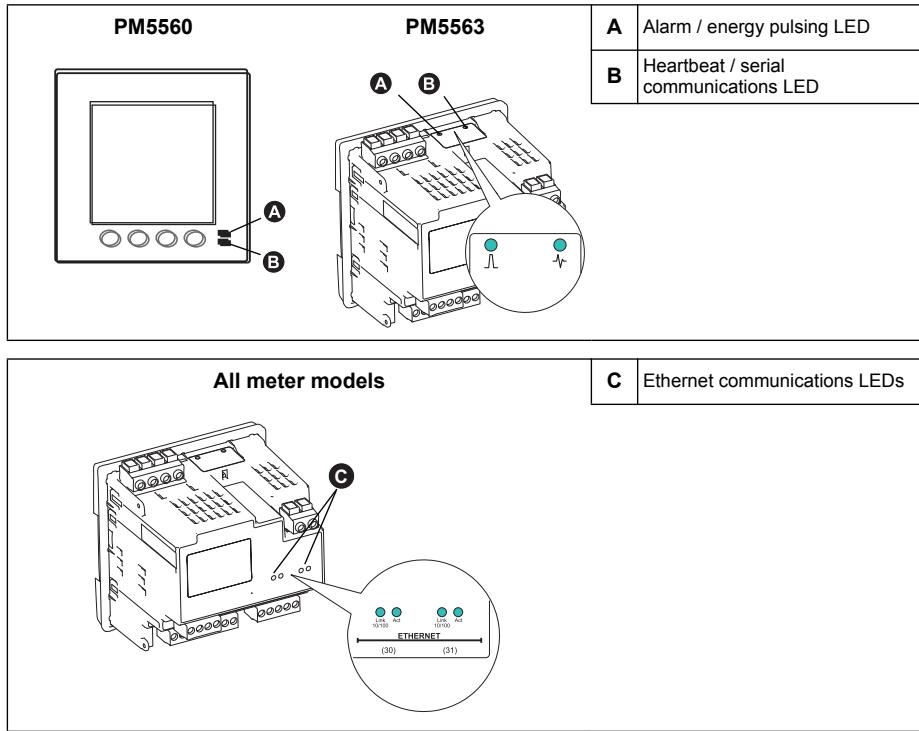
Alarm / energy pulsing LED

The alarm / energy pulsing LED can be configured for alarm notification or energy pulsing.

When configured for alarm notification, this LED flashes when a high, medium or low priority alarm is tripped. The LED provides a visual indication of an active alarm condition or an inactive but unacknowledged high priority alarm.

When configured for energy pulsing, this LED flashes at a rate proportional to the amount of energy consumed. This is typically used to verify the power meter's accuracy.

Related topics

- See "Energy pulsing" on page 81 for details on configuring the alarm / energy pulsing LED for energy pulsing.
- See "LED alarm indicator" on page 101 for details on configuring the alarm / energy pulsing LED for alarming.

Heartbeat / serial communications LED

The heartbeat / serial communications LED blinks at a slow, steady rate to indicate the meter is operational. The LED flashes at a variable, faster rate when the meter is communicating over a Modbus serial communications port.

You cannot configure this LED for other purposes.

NOTICE

UNINTENDED EQUIPMENT OPERATION

A heartbeat LED that remains lit and does not blink (or flash) indicates a hardware problem. In this case, power down the meter and reapply power. If the LED still does not blink or flash, contact Technical Support.

Failure to follow these instructions may render your device inoperable.

Ethernet communications LEDs

The Link LED blinks to indicate the speed at which data is being transmitted or received. The Act (active) LED indicates the meter is communicating through the Ethernet port.

You cannot configure these LEDs for other purposes.

Before you begin

Carefully read and follow the safety precautions before working with the meter.

Safety precautions

Installation, wiring, testing and service must be performed in accordance with all local and national electrical codes.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA or applicable local standards.
- Turn off all power supplying this device before working on it.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Do not exceed the device's ratings for maximum limits.
- Always use grounded external CTs for current inputs.

Failure to follow these instructions will result in death or serious injury.

1. Turn off all power supplying this device before working on it.

2. Always use a properly rated voltage sensing device to confirm that all power is off.

Meter mounting

This section describes how to mount the meter.

Mounting the PM5560

The meter is designed to be mounted inside a 1/4-DIN panel cutout.

1. Inspect the gasket (installed around the perimeter of the front display) and make sure it is secured properly and not damaged.
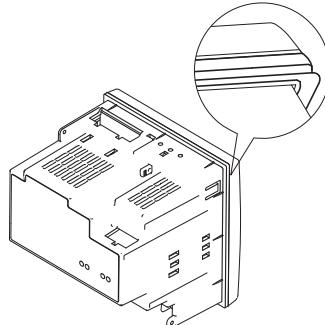
2. Insert the meter through the mounting hole.
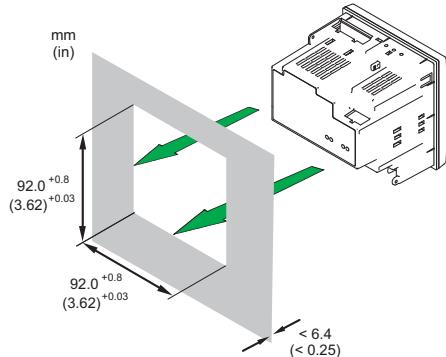
3. Line up the tabs of the retainer clips with the slots on either side of the meter. While holding the retainers at a slight angle, push the retainers in and forward to position them in place. In situations where the spacing between meters is tight, use a flat-head screwdriver with a long, narrow shaft to help secure the clips.
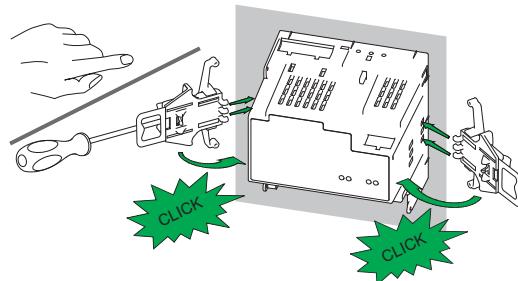
4. Push the middle of the clip assembly to lock the retainer in place and secure the meter.
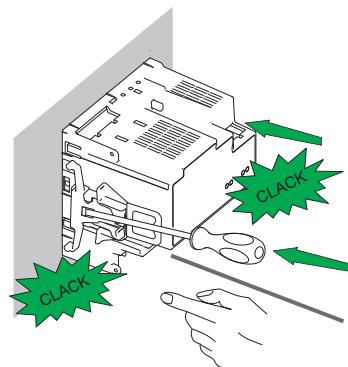
Mounting the PM5563

The meter is designed to be mounted on a TS35 Top-Hat style DIN rail.

1. Line up the meter to the DIN rail. Tilt the meter slightly so the top notch is resting securely on the DIN rail.
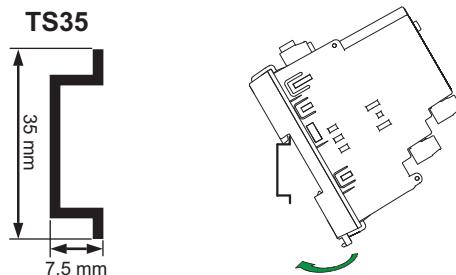
2. Swing the meter downward and push the bottom part of the meter until you hear an audible click and the meter locks in place.
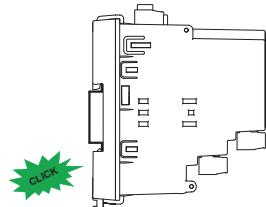
Removing the PM5563

1. Insert a flat-tip screwdriver into the DIN release clip. Pull down the clip until you hear an audible click and the DIN clip is unlocked.
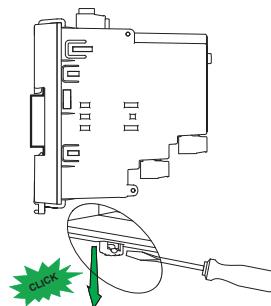
2. Swing the meter out and upwards to remove the meter.
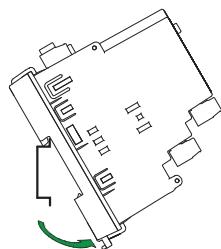
Meter wiring

For wiring instructions and safety precautions, see the meter installation sheet that was shipped with your meter, or download a copy at www.schneider-electric.com.

- Wire connections to the meter's voltage inputs, control power, digital outputs, digital (status) inputs and RS-485 communications are terminated using the supplied pluggable wire connectors.
- When wiring the meter's current inputs, terminate the wire ends with ring or split-ring crimp connectors.

Use the meter installation sheet when wiring the meter.

Connector locations

A	Voltage inputs
B	Control power
C	Ethernet ports
D	Digital outputs
E	Current inputs
F	Digital (status) inputs
G	RS-485 port
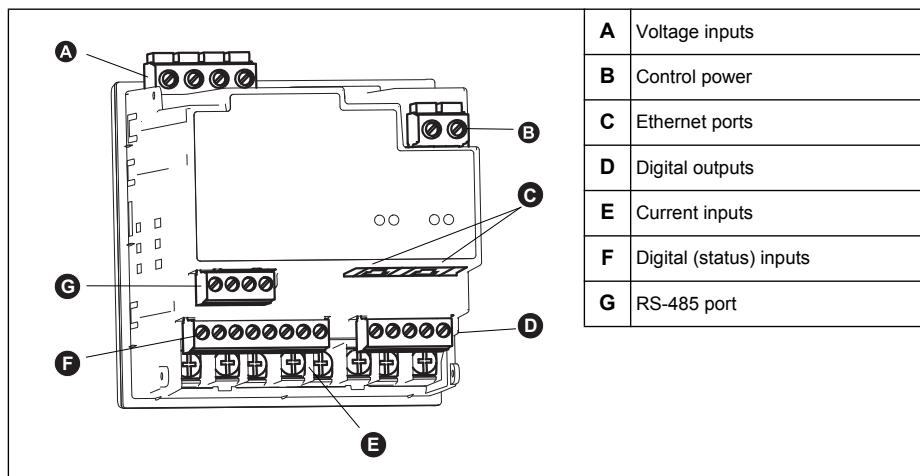
Power system

This section outlines typical requirements for wiring the voltage and current inputs of the meter to the electrical power system.

For wiring instructions and safety precautions, see the meter installation sheet that was shipped with your meter, or download a copy at www.schneider-electric.com.

Related topics
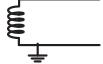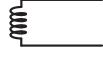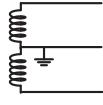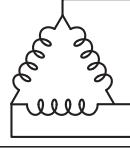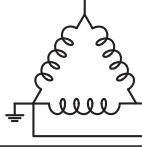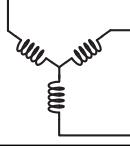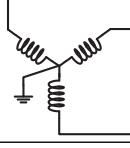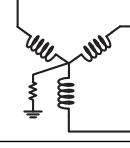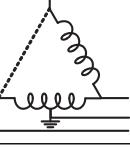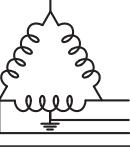
- See "Specifications" on page 28 for voltage and current input limits.

Direct connect voltage limits

You can connect the meter's voltage inputs directly to the phase voltage lines of the power system if the power system's line-to-line or line-to-neutral voltages do not exceed the meter's direct connect maximum voltage limits. The meter's voltage measurement inputs are rated by the manufacturer for up to 400 V L-N / 690 V L-L. However, the maximum voltage allowed for direct connection may be lower, depending on the local electrical codes and regulations. In US and Canada the maximum voltage on the meter voltage measurement inputs may not exceed 347 V L-N / 600 V L-L.

If your system voltage is greater than the specified direct connect maximum voltage, you must use VTs (voltage transformers) to step down the voltages.

Power system setup parameters

Power system description — Meter setting	Symbol	Direct connect maximum		# of VTs (if required)
		UL	IEC	
Single-phase 2-wire line-to-neutral — 1PH2W LN		480 V L-N	480 V L-N	1 VT
Single-phase 2-wire line-to-line — 1PH2W LL		600 V L-L	600 V L-L	1VT
Single-phase 3-wire line-to-line with neutral — 1PH3W LL with N		347 V L-N / 600 V L-L	400 V L-N / 690 V L-L	2VT
3-phase 3-wire Delta ungrounded — 3PH3W Dlt Ungnd		600 V L-L	600 V L-L	2 VT
3-phase 3-wire Delta corner grounded — 3PH3W Dlt Crnr Gnd		600 V L-L	600 V L-L	2 VT
3-phase 3-wire Wye ungrounded — 3PH3W Wye Ungnd		600 V L-L	600 V L-L	2 VT
3-phase 3-wire Wye grounded — 3PH3W Wye Gnd		600 V L-L	600 V L-L	2 VT
3-phase 3-wire Wye resistance-grounded — 3PH3W Wye Res Gnd		600 V L-L	600 V L-L	2 VT
3-phase 4-wire open Delta center-tapped — 3PH4W Opn Dlt Ctr Tp		240 V L-N / 415 V L-N / 480 V L-L	240 V L-N / 415 V L-N / 480 V L-L	3 VT
3-phase 4-wire Delta center-tapped — 3PH4W Dlt Ctr Tp		240 V L-N / 415 V L-N / 480 V L-L	240 V L-N / 415 V L-N / 480 V L-L	3 VT

Power system setup parameters (Continued)

Power system description — Meter setting	Symbol	Direct connect maximum		# of VTs (if required)
		UL	IEC	
3-phase 4-wire ungrounded Wye — 3PH4W Wye Ungnd		347 V L-N / 600 V L-L	347 V L-N / 600 V L-L	3 VT or 2 VT
3-phase 4-wire grounded Wye — 3PH4W Wye Gnd		347 V L-N / 600 V L-L	400 V L-N / 690 V L-L	3 VT or 2 VT
3-phase 4-wire resistance-grounded Wye — 3PH4W Wye Res Gnd		347 V L-N / 600 V L-L	347 V L-N / 600 V L-L	3 VT or 2 VT

Voltage and current input wiring

For wiring instructions and safety precautions, see the meter installation sheet that was shipped with your meter, or download a copy at www.schneider-electric.com.

Voltage input protection

The meter's voltage inputs must be wired to fuses/breakers and a disconnect switch. If using a voltage transformer (VT), both primary and secondary sides of the VT must be wired to fuses/breakers and disconnect switches.

- Clearly label the device's disconnect circuit mechanism and install it within easy reach of the operator.
- The fuses / circuit breakers must be rated for the installation voltage and sized for the available fault current.
- Fuse for neutral terminal is required if the source neutral connection is not grounded.

See the meter installation sheet for fuse ratings.

Current input protection

For all connected current inputs, use a CT shorting block to short-circuit the secondary leads of the CTs before removing the current input connections to the meter.

NOTE: Ground any unused current inputs.

Balanced system considerations

In situations where you are monitoring a balanced 3-phase load, you may choose to connect only one or two CTs on the phase(s) you want to measure, and then configure the meter so it calculates the current on the unconnected current input(s).

NOTE: For a balanced 4-wire Wye system, the meter's calculations assume that there is no current flowing through the neutral conductor.

Balanced 3-phase Wye system with 2 CTs

The current for the unconnected current input is calculated so that the vector sum for all three phase currents equal zero.

Balanced 3-phase Wye or Delta system with 1 CT

The currents for the unconnected current inputs are calculated so that their magnitude and phase angle are identical and equally distributed, and the vector sum for all three phase currents equal zero.

NOTE: You must always use 3 CTs for 3-phase 4-wire center-tapped Delta or center-tapped open Delta systems.

Neutral and ground current

The fourth current input (I4) can be used to measure current flow (In) in the neutral conductor, which can then be used to calculate residual current. The meter refers to residual current as ground current (Ig).

For 4-wire Wye systems, ground current is calculated as the difference between the measured neutral current and the vector sum of all measured phase currents.

Control power wiring

For wiring instructions and safety precautions, see the meter installation sheet that was shipped with your meter, or download a copy at www.schneider-electric.com.

The meter can be powered from an AC or DC power source.

- L1 and L2 are non-polarized. If using an AC power supply with neutral, connect neutral to the meter's L2 terminal.
- Always use a fuse on L1. Fuse L2 when connecting an ungrounded neutral to the control power.
- If using a control power transformer, fuse both primary and secondary sides of the transformer.
- The fuses / circuit breakers must be rated for the installation voltage and sized for the available fault current.

Communications

This section provides additional information about the communications ports and topologies supported by the meter. You must wire and configure the RS-485 port and/or the Ethernet port in order to communicate with the meter.

Serial communications

The meter supports serial communications through the RS-485 port. Up to 32 devices can be connected on a single RS-485 bus.

In an RS-485 network, there is one master device, typically an Ethernet to RS-485 gateway. It provides the means for RS-485 communications with multiple slave devices (for example, meters). For applications that require only one dedicated computer to communicate with the slave devices, an RS-232 to RS-485 converter can be used as the master device.

RS-485 wiring

Connect the devices on the RS-485 bus in a point-to-point configuration, with the (+) and (-) terminals from one device connected to the corresponding (+) and (-) terminals on the next device.

RS-485 wiring
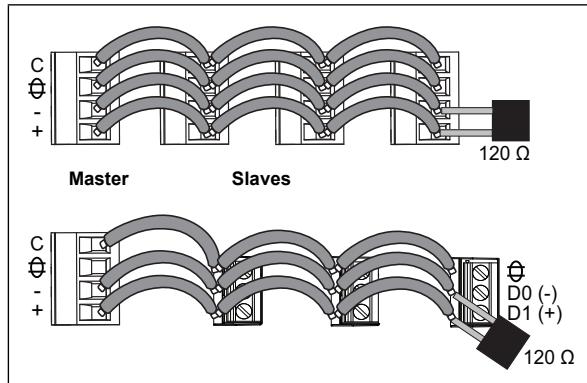
RS-485 cable

Use a shielded 1.5 twisted pair or 2 twisted pair RS-485 cable to wire the devices. Use one twisted pair to connect the (+) and (-) terminals, and use the other insulated wire to connect the C terminals.

RS-485 terminals

C	Common. This provides the voltage reference (zero volts) for the data plus and data minus signals.
⏚	Shield. Connect the bare wire to this terminal to help suppress signal noise that may be present. Ground the shield wiring at one end only (either at the master or the last slave device, but not both).
-	Data minus. This transmits/receives the inverting data signals.
+	Data plus. This transmits/receives the non-inverting data signal.

NOTE: If some devices in your RS-485 network do not have the C terminal, use the bare wire in the RS-485 cable to connect the C terminal from the meter to the ⏚ terminal on the devices that do not have the C terminal.

RS-485 maximum cable length

The total distance for devices connected on an RS-485 bus should not exceed 1200 m (4000 ft).

EGX series considerations

The PowerLogic™ EGX series Ethernet gateway allows you to connect multiple devices using RS-485. See the applicable EGX documentation for details on adding devices to the EGX.

RS-485 network configuration

After you have wired the RS-485 port and powered up the meter, you must configure the serial communications port in order to communicate with the meter.

Each device on the same RS-485 communications bus must have a unique address and all connected devices must be set to the same protocol, baud rate, and parity (data format).

NOTE: To communicate with the meter using ION Setup, you must set the serial site and all connected devices in the RS-485 network to the same parity setting.

For meters that do not have a display, you must first wire and configure each one separately before connecting these meters to the same RS-485 bus.

Related topics

- To configure RS-485 communications on a meter equipped with a display panel, see "Setting up serial communications" on page 41.
- To configure RS-485 communications on a meter that does not have a display panel, see "RS-485 port setup" on page 50

Ethernet communications

The meter uses Modbus TCP protocol to communicate at data speeds up to 100 Mbps through its Ethernet communications port.

The meter supports a single IP address between two 10/100Base-T Ethernet ports. The second Ethernet port functions as an Ethernet switch, which allows you to have shorter Ethernet cable runs between the meters without requiring additional Ethernet routers or repeaters. This helps simplify network connections and reduce installation time and costs.

Use a Cat 5 cable to connect the meter's Ethernet port. Your Ethernet connection source should be installed in a location that minimizes the overall Ethernet cable routing length.

Ethernet wiring
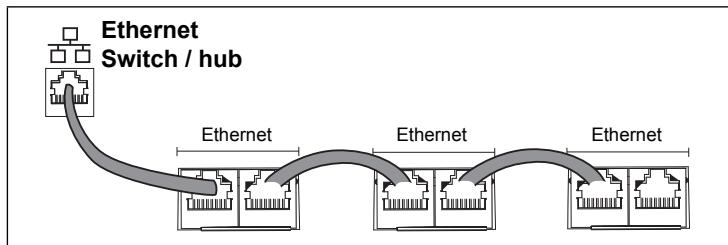
Ethernet configuration

To communicate with the meter through Ethernet, all devices must have a unique IP address and be set to the same subnet mask and gateway.

NOTE: For meters that do not have a display, you must configure each one separately in order to set a unique IP address for each device.

- To configure Ethernet communications on a meter equipped with a display panel, see "Setting up Ethernet communications" on page 42.
- To configure Ethernet communications on a meter that does not have a display panel, see "Using a web browser to set up Ethernet" on page 49.

Digital outputs

The meter is equipped with two Form A digital output ports (D1, D2). You can configure the digital outputs for use in the following applications:

- switching applications, for example, to provide on/off control signals for switching capacitor banks, generators, and other external devices and equipment

- demand synchronization applications, where the meter provides pulse signals to the input of another meter to control its demand period

- energy pulsing applications, where a receiving device determines energy usage by counting the kWh pulses coming from the meter's digital output port

The digital outputs can handle voltages less than 30 V AC or 60 V DC. For higher voltage applications, use an external relay in the switching circuit.

Digital output connections
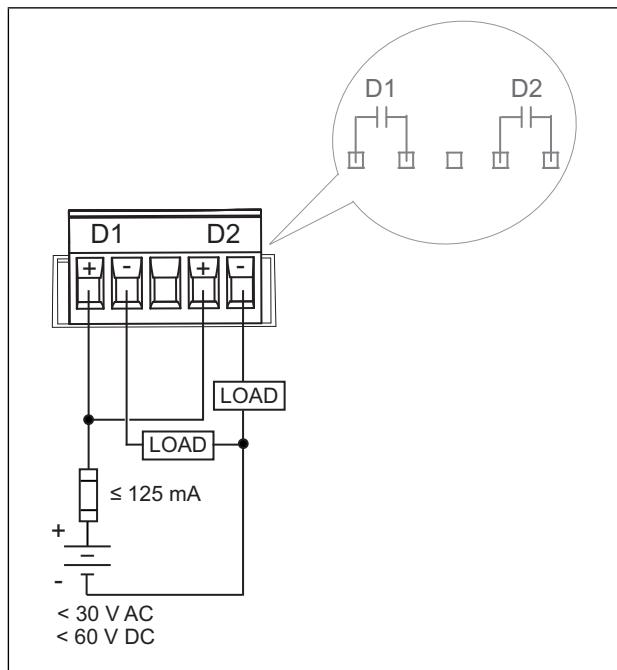
Related topics

- See "Digital output applications" on page 77 for digital output use and configuration details.

Digital inputs

The meter is equipped with four digital input ports (S1 to S4). You can configure the digital inputs for use in status monitoring or input metering applications.

The meter's digital inputs require an external voltage source to detect the digital input's on/off state. The meter detects an on state if the external voltage appearing at the digital input is within its operating range.

The digital inputs require a 18 - 30 V AC or 12 - 30 V DC external voltage source to detect the digital input's on/off state.

Digital input connections
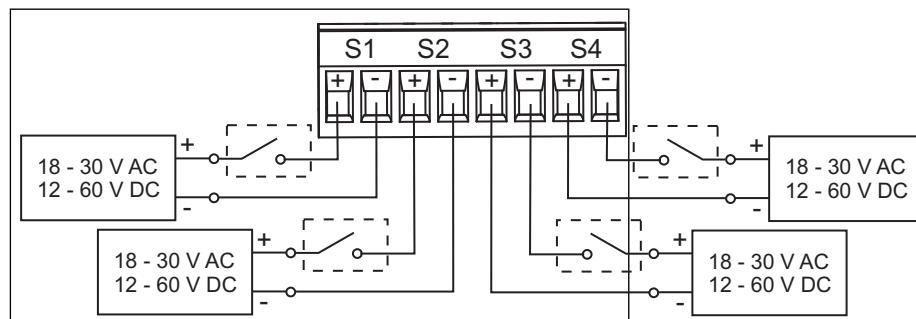
Related topics

- See "Digital input applications" on page 71 for digital input use and configuration details.

Specifications

The information contained in this section is subject to change without notice. See your product's technical datasheet at www.schneider-electric.com for the most current and complete specifications.

For wiring information (gauge, strip length/termination, tool and torque), refer to the meter installation sheet.

Mechanical

Meter dimensions
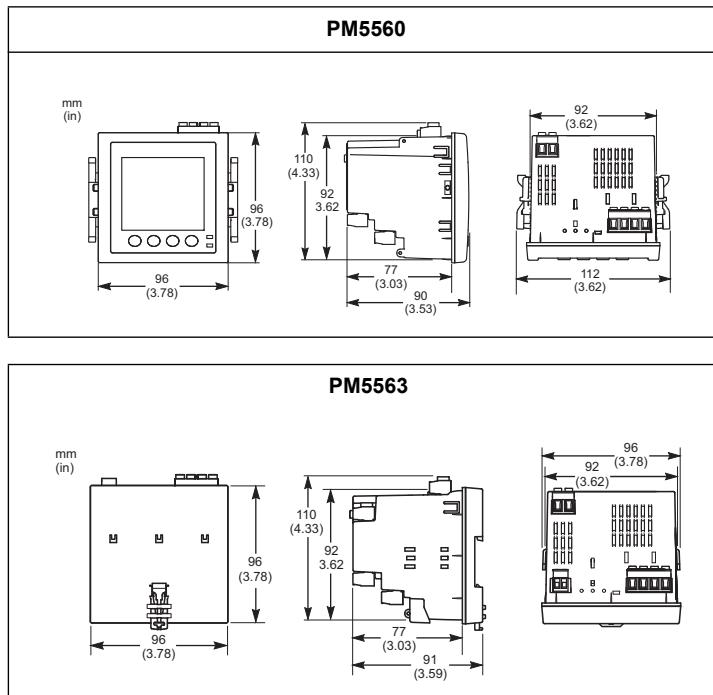
Mechanical characteristics

Integrated display model	IP degree of protection (IEC 60529)	Front display: IP52 Meter body: IP30
	IP rating	Front display: UL Type 12
	Panel thickness	6.0 mm (0.25 in) maximum
	Gasket thickness	1.0 mm (0.04 in)
	Mounting position	Vertical
	Display type	Monochrome graphics LCD, 128 x 128 resolution
	Display backlight	White LED
	Viewable area	67 x 62.5 mm (2.64 x 2.46 in)
	Keypad	4 button
	Front panel LED indicators	Green LED (heartbeat / communications activity)
		Amber LED (active alarm indicator or energy pulse output)
DIN rail mount model	Mounting position	35 mm DIN rail
	LED indicators (top)	Amber LED (active alarm indicator / energy pulsing
		Green LED (heartbeat / communications activity)
	IP degree of protection (IEC 60529)	IP30

Electrical

Electrical characteristics

Type of measurement		True RMS up to the 63rd harmonic on three-phase (3P, 3P + N)
		128 samples per cycle, zero blind
Measurement accuracy	IEC 61557-12	PMD/[SD|SS]/K70/0.2
	Active energy	±0.2% Class 0.2S, as per IEC 62053-22
	Reactive energy	±2% Class 2, as per IEC 62053-23
	Active power	±0.2% as per IEC 61557-12
	Reactive power	±1% as per IEC 61557-12
	Apparent power	±0.5% as per IEC 61557-12
	Current (5 A nominal, per phase)	±0.15%
	Voltage (L-N)	±0.1%
	Frequency	±0.05%
Power quality accuracy, as per IEC 61557-12	Voltage unbalance	2.0%
	Voltage harmonics	2.0%
	Voltage THD	2.0%
	Current harmonics	2.0%
	Current THD	2.0%
Voltage inputs	VT primary	1.0 MV AC max
	Measured voltage	20 to 400 V L-N / 20 to 690 V L-L (Wye) or 20 to 600 V L-L (Delta) UL Listed up to 347 V L-N / 600 V L-L
	Measurement category	CAT III (6 kV rated impulse voltage)
	Overload	480 V L-N / 828 V L-L
	Impedance	5 MΩ
	Frequency	50 or 60 Hz ±10% (45 - 70 Hz)
Current inputs	CT primary	32767 A max
	CT secondary	Nominal: 5A (Class 0.2S) or 1 A (Class 0.5S)
	Starting current	5 mA
	Measured current with overrange and crest factor	50 mA to 10 A
	Withstand	20 A continuous 50 A at 10 sec/hr 500 A at 1 sec/hr
	Impedance	< 0.3 mΩ
	Frequency	50 or 60 Hz ±10% (45 - 70 Hz)
	Burden	< 0.024 VA at 10 A
AC control power	Operating range	100 to 480 V AC ± 10%
	Installation category	CAT III 600V class per IEC 61010-1 edition 3
	Burden	5.0 W / 16.0 VA / 15.2 VAR max at 480 V AC
	Frequency	50 or 60 Hz ±10%
	Ride-through time	35 ms typical at 120 V L-N and maximum burden 129 ms typical at 230 V L-N and maximum burden
DC control power	Operating range	125 to 250 V DC ±20%
	Burden	3.1 W typical, 5.0 W maximum at 125 V DC
	Ride-through time	50 ms typical at 125 V DC and maximum burden

Electrical characteristics (Continued)

Digital outputs	Number / type	2 - Form A solid-state digital outputs
	Load voltage	30 V AC / 60 V DC maximum
	Load current	125 mA maximum
	ON resistance	8 Ω
	Pulse frequency	25 Hz maximum
	Meter constant	1 to 9,999,999 pulses per kWh
	Pulse width	50% duty cycle (20 ms minimum ON time)
	Leakage current	1 micro Amps
	Isolation	2.5 kV RMS for 60 seconds
Active alarm / energy pulsing LED	Type	Amber LED, optical
	Pulse frequency	2.5 kHz maximum
	Pulse width	50% duty cycle (200 microseconds minimum ON time)
	Meter constant	1 to 9,999,999 pulses per kWh
	Wavelength	590 to 635 nm
Status inputs	Number / type	4 - Externally excited digital inputs
	Voltage ratings	ON state: 15 - 30 V AC / 15 - 60 V DC OFF state: 0 - 6 V AC / 0 - 6 V DC
	Input resistance	100 kΩ
	Frequency	25 Hz maximum
	Pulse width	50% duty cycle (20 ms minimum ON time)
	Response time	10 ms
	Opto Isolation	2.5 kV RMS for 60 seconds
	Input burden	2 mA at 24 V AC/DC 2.5 mA at 60 V AC/DC

Environmental characteristics

Operating temperature	Meter	-25 to 70 °C (-13 to 158 °F)
	Display	-20 to 70 °C (-4 to 158 °F). Display functions to -25 ºC (-13 °F) with reduced performance.
Storage temperature	Meter and display	-40 to 85 °C (-40 to 185 °F)
Humidity rating		5 to 95% RH non-condensing at 50 °C (122 °F)
Pollution degree		2
Altitude		< 3000 m (9843 ft)
Location		Not suitable for wet locations.

EMC (electromagnetic compatibility)

Harmonic current emissions	IEC 61000-3-2
Flicker (voltage fluctuation) limits	IEC 61000-3-3
Electrostatic discharge	IEC 61000-4-2
Immunity to radiated fields	IEC 61000-4-3
Immunity to fast transients	IEC 61000-4-4
Immunity to surge	IEC 61000-4-5
Conducted immunity 150kHz to 80MHz	IEC 61000-4-6
Immunity to magnetic fields	IEC 61000-4-8
Immunity to voltage dips	IEC 61000-4-11
Immunity to damped oscillatory waves	IEC 61000-4-12
Radiated emissions	FCC part 15, EN55022 Class B
Conducted emissions	FCC part 15, EN55022 Class B

Safety

Europe	LVD compliance (EN61010-1:2010)
U.S. and Canada	cULus (UL61010-1:2012, CSA22.2 No.61010-1-12)
Protective class	Protective class II. Double insulated for user accessible parts.

RS-485 communications

Number of ports	1
Maximum cable length	1219 m (4000 ft)
Unit loads	Up to 32 devices on the same bus
Parity	Even, Odd, None (1 stop bit for Odd or Even parity; 2 stop bits for None)
Baud rate	9600, 19200, 38400 baud
Protocol	Modbus RTU, Modbus ASCII (7 or 8 bit), JBUS
Firmware and language file update	Update via the communication port using DLF3000
Isolation	2.5 kV RMS, double insulated

Ethernet communications

Number of ports	2 (same MAC address — the second Ethernet jack functions as an Ethernet switch for daisy-chaining devices)
Maximum cable length	100 m (328 ft), per TIA/EIA 568-5-A
Mode	10Base-T, 100Base-TX, Auto-MDIX
Protocol	Modbus TCP, HTTP, FTP, DHCP, BOOTP
Firmware and language file update	Update via the communication port using DLF3000

Real-time clock

Clock drift	~ 0.4 seconds per day (typical)
Battery backup time	4.5 years without control power (typical)

Related topics

• For additional information, visit the website at www.schneider-electric.com and search for "PM5500 technical datasheet".

Chapter 3   Front panel display and meter setup

This section applies to meters that are equipped with a front panel display. The front panel display lets you use the meter to perform various tasks such as setting up the meter, displaying data screens, acknowledging alarms, or performing resets.

Parts of the display

A	Navigation / menu selection buttons
B	Heartbeat / communications LED (green)
C	Alarm / energy pulsing LED (orange)
D	Navigation symbols or menu options
E	Right notification area
F	Screen title
G	Left notification area
H	Cursor
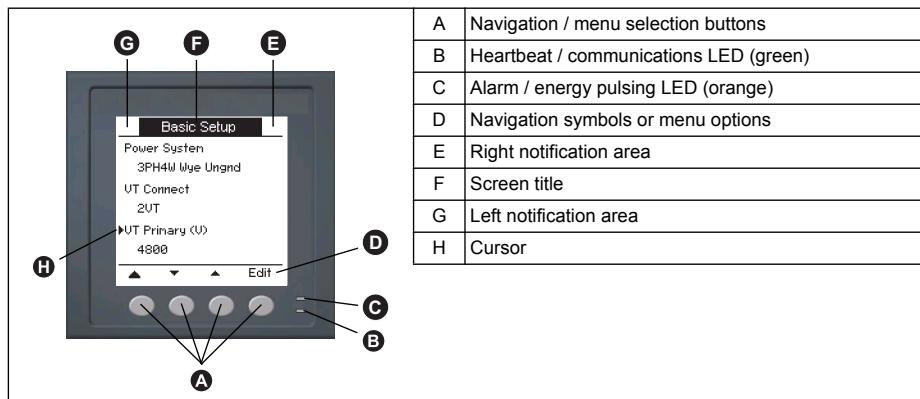
LED indicators

The meter has two LED indicators on the front panel.

Front panel LEDs
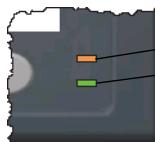
C   Alarm / energy pulsing LED (orange)
B   Heartbeat / communications LED (green)

Heartbeat / communications LED

The (green) heartbeat / communications LED blinks at a slow, steady rate to indicate the meter is operational. The LED flashes at a variable, faster rate when the meter is communicating over a Modbus serial communications port.

You cannot configure this LED for other purposes.

NOTICE

UNINTENDED EQUIPMENT OPERATION

A heartbeat LED that remains lit and does not blink (or flash) indicates a hardware problem. In this case, power down the meter and reapply power. If the LED still does not blink or flash, contact Technical Support.

Failure to follow these instructions may render your device inoperable.

Related topics

- See "Troubleshooting LED indicators" on page 125 for additional maintenance information.

Alarm / energy pulsing LED modes

The (orange) alarm / energy pulsing LED can be configured for alarm notification or energy pulsing.

- When configured for alarm notification, this LED flashes when a high, medium or low priority alarm is tripped. The LED provides a visual indication of an active alarm condition, or an inactive but unacknowledged high priority alarm.
- When configured for energy pulsing, this LED flashes at a rate proportional to the amount of energy consumed. This is typically used to verify the power meter's accuracy.

Related topics

- See "Energy pulsing" on page 81 for details on changing the LED mode for energy pulsing applications.
- See "LED alarm indicator" on page 101 for details on changing the LED mode for alarming applications.

Notification icons

To alert you about meter state or events, notification icons appear at the top left or top right corner of the display screen.

Notification icons

Icon	Description
	The wrench icon indicates that the power meter is in an overvoltage condition or requires maintenance. See "Maintenance and upgrades" on page 125.
	The alarm icon indicates an alarm condition has occurred. See "Alarm display and notification" on page 102 and "Alarm priorities" on page 96.

Meter screen menus

All meter screens are grouped logically, according to their function. You can access any available meter screen by first selecting the Level 1 (top level) screen that contains it.

Level 1 screen menus - IEEE display mode

Amps → Volts → Harm → Power → Energy → PF → Hz → THD
→ Unbal ← MnMx ← Alarm ← I/O ← Timer ← Maint ← Clock
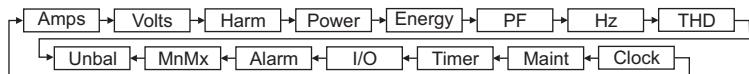
Level 1 screen menus - IEC display mode

I → U-V → Harm → PQS → E → PF → F → THD
→ Unbal ← MnMx ← Alarm ← I/O ← Timer ← Maint ← Clock
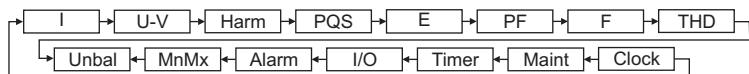
Use the buttons to navigate the different meter screens. The navigation symbols and their functions are explained below:

Navigation symbols

Symbol	Description
▶	Scroll right and display more menu items
▲	Exit screen and go up one level
▼	Move cursor down the list of options or display more items below
▲	Move cursor up the list of options or display more items above
◀	Move cursor one character to the left
▶	Move cursor one character to the right
+	Increase the highlighted value or show the next item in the list
−	Show the previous item in the list
⬤ ⬤ ⬤ ⬤	Front panel buttons

When you reach the last screen, press ▶ again to cycle through the screen menus.

Menu tree

This summarizes the meter screens (IEEE menus shown, with the corresponding IEC menus in parentheses — see "Setting up regional settings" on page 44). For detailed descriptions of the meter screens, see "Viewing meter data" on page 63.

PM5560 meter display screen menus

Level 1	Level 2	Level 3
Amps (I)	Phase / Dmd / Ig	Dmd → Iavg, Ia, Ib, Ic, In, Ig
Volts (U-V)	V L-L (U) / V L-N (V)	
Harm	V L-L (U)	Fund, 3-11, 13-21, 23-31
	V L-N (V)	Fund, 3-11, 13-21, 23-31
	Amps (I)	Fund, 3-11, 13-21, 23-31
	TDD / K	
	Crest	Amps (I), V L-L (U), V L-N (V)
Power (PQS)	Power (PQS)	
	Phase	Active (P), Reac (Q), Appr (S)
	Dmd	Wd (Pd) → Tot, A, B, C
		VARd (Qd) → Tot, A, B, C
		VAd (Sd) → Tot, A, B, C
Energy (E)	Wh / VAh / VARh	
	Tariff	T1, T2, T3, T4, T5, T6, T7, T8
	Inp Mtr	Dmd → Ch 1, Ch 2, Ch 3, Ch 4
PF	True / Disp	
Hz (F)		
THD	THD	Amps (I), V L-L (U), V L-N (V)
	thd	Amps (I), V L-L (U), V L-N (V)
Unbal		
MnMx	Amps (I)	
	Volts (U-V)	V L-L (U), V L-N (V)
	Power (PQS)	Active (P), Reac (Q), Appr (S)
	PF	True, Disp
	Hz (F)	
	THD	THD, thd
	Unbal	Amps (I), V L-L (U), V L-N (V)
Alarm	Active / Hist / Count / Unack	
I/O	D Out / D In	
Timer	Load / Oper	
Maint	Reset	
	Setup	Meter → Basic, Adv, Dmd, Tariff
		Comm → Serial, Enet
		Alarm → 1-Sec, Unary, Dig, Logic, Cust1s
		I/O → LED, D In, D Out, Inp Mtr
		HMI → Displ, Region, Pass
		Clock
	Diag	Info
		Meter
		Cl Pwr
		Phasor → Polar
Clock		

Meter setup screen navigation

The meter's front panel buttons and display screen allow you to navigate and configure the meter's setup parameters. The following illustration shows one of the meter setup screens.

Basic setup screen
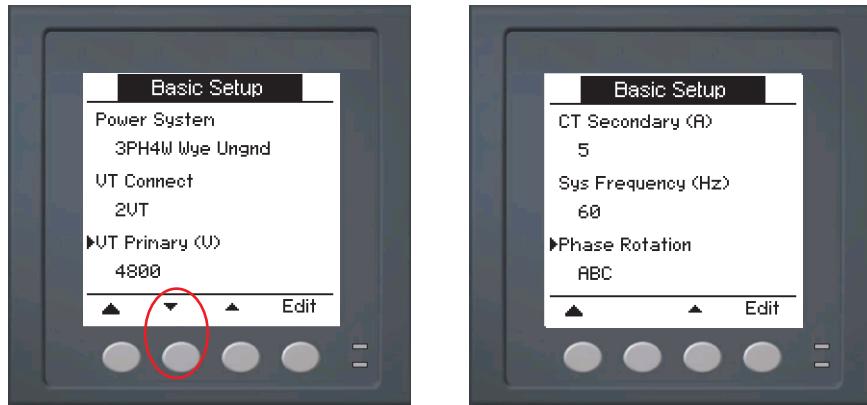
In this example, the down arrow (▼) indicates there are more parameters below the selected option (▶). Press the down arrow button to display additional parameters. The down arrow disappears when the last item in the list is selected, and there are no more parameters to display.

Front panel meter setup

Meter configuration can be performed directly through the front panel buttons or remotely through software. This section contains instructions on setting up the meter using the front panel.

Related topics

Configuring basic setup parameters

Proper configuration of the meter's basic setup parameters is essential for accurate measurement and calculations. Use the Basic Setup screen to define the electrical power system that the meter is monitoring.

NOTICE
UNINTENDED EQUIPMENT OPERATION
After modifying any basic setup parameter:
• Verify all standard alarms settings are correct and make adjustments as necessary.
• Re-enable all configured alarms.
Failure to follow these instructions can result in incorrect alarm functions.

If standard (1-sec) alarms have been configured and you make subsequent changes to the meter's basic setup, all alarms are disabled to prevent undesired alarm operation. After saving the changes, confirm all configured standard alarm settings are still valid, reconfigure them as required, and re-enable the alarms.

Basic setup menu tree
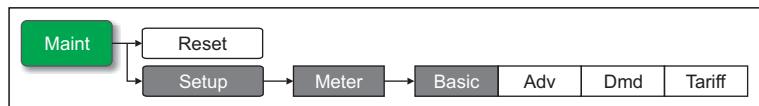
1. Navigate to **Maint > Setup**.

2. Enter the setup password (default is "0"), then press **OK**.

3. Navigate to **Meter > Basic**.

4. Move the cursor to point to the parameter you want to modify, then press **Edit**.

5. Modify the parameter as required, then press **OK**.

6. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.

Basic setup parameters

Parameter	Values	Description
Power System	Select the power system type (power transformer) the meter is wired to.	
	1PH2W LN	Single-phase 2-wire line-to-neutral
	1PH2W LL	Single-phase 2-wire line-to-line
	1PH3W LL with N	Single-phase 3-wire line-to-line with neutral
	3PH3W Dlt Ungnd	3-phase 3-wire ungrounded delta
	3PH3W Dlt Crnr Gnd	3-phase 3-wire corner grounded delta
	3PH3W Wye Ungnd	3-phase 3-wire ungrounded wye
	3PH3W Wye Gnd	3-phase 3-wire grounded wye
	3PH3W Wye Res Gnd	3-phase 3-wire resistance-grounded wye
	3PH4W Opn Dlt Ctr Tp	3-phase 4-wire center-tapped open delta
	3PH4W Dlt Ctr Tp	3-phase 4-wire center-tapped delta
	3PH4W Wye Ungnd	3-phase 4-wire ungrounded wye
	3PH4W Wye Gnd	3-phase 4-wire grounded wye
	3PH4W Wye Res Gnd	3-phase 4-wire resistance-grounded wye
VT Connect	Select how many voltage transformers (VT) are connected to the electrical power system.	
	Direct Con	Direct connect; no VTs used
	2VT	2 voltage transformers
	3VT	3 voltage transformers
VT Primary (V)	1 to 1,000,000	Enter the size of the VT primary, in Volts.
VT Secondary (V)	100, 110, 115, 120	Select the size of the VT secondary, in Volts.
CT on Terminal	Define how many current transformers (CT) are connected to the meter, and which terminals they are connected to.	
	I1	1 CT connected to I1 terminal
	I2	1 CT connected to I2 terminal
	I3	1 CT connected to I3 terminal
	I1 I2	2 CT connected to I1, I2 terminals
	I1 I3	2 CT connected to I1, I3 terminals
	I2 I3	2 CT connected to I2, I3 terminals
	I1 I2 I3	3 CT connected to I1, I2, I3 terminals
	I1 I2 I3 IN	4 CT connected to I1, I2, I3, IN terminals
CT Primary (A)	1 to 1000000	Enter the size of the CT primary, in Amps.
CT Secondary (A)	1, 5	Select the size of the CT secondary, in Amps.
CT Primary Neu. (A)	1 to 32767	This parameter displays when CT on Terminal is set to I1,I2,I3, IN. Enter the size of the 4th (Neutral) CT primary, in Amps.
CT Sec. Neu. (A)	1, 5	This parameter displays when CT on Terminal is set to I1,I2,I3, IN. Select the size of the 4th (Neutral) CT secondary, in Amps.

Basic setup parameters (Continued)

Parameter	Values	Description
Sys Frequency (Hz)	50, 60	Select the frequency of the electrical power system, in Hz.
Phase Rotation	ABC, CBA	Select the phase rotation of the 3-phase system.

7. Press **Yes** to save your changes.

Related topics

- See "Power system" on page 20 for descriptions and symbols of the different electrical power systems supported by the meter.
- See "Meter configuration using ION Setup" on page 53 to set up the meter using ION Setup.

Configuring advanced setup parameters

The advanced setup screens let you configure the following:

- Load timer setpoint: defines the active load current, which is the minimum input current required to start and keep the active load timer counting.
- Peak current demand for total demand distortion: specifies the minimum current demand value required to include in total demand distortion calculations.

Advanced setup menu tree
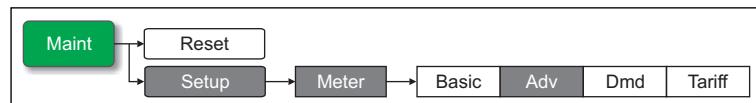
1. Navigate to **Maint > Setup**.

2. Enter the setup password (default is "0"), then press **OK**.

3. Navigate to **Meter > Advan**.

4. Move the cursor to point to the parameter you want to modify, then press **Edit**.

5. Modify the parameter as required, then press **OK**.

6. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.

Advanced setup parameters

Parameter	Values	Description
Label	—	This label identifies the device, e.g., "Power Meter". You cannot use the front panel to edit this parameter. Use ION Setup to change the device label.
Load Timer Setpt (A)	0 - 9	Specifies the minimum average current at the load before the timer starts. The meter begins counting the number of seconds the load timer is on (i.e., whenever the readings are equal to or above this average current threshold.
Pk I dmd for TDD (A)	0 - 9	Specifies the minimum peak current demand at the load for inclusion in total demand distortion (TDD) calculations. If the load current is below the minimum peak current demand threshold, the meter does not use the readings to calculate TDD. Set this to "0" (zero) if you want the power meter to use the metered peak current demand for this calculation.

7. Press **Yes** to save your changes.

Related topics

- See "Meter configuration using ION Setup" on page 53 to set up the meter using ION Setup.

Demand setup

Demand is a measure of average consumption over a fixed time interval.

Use the Demand setup screens to define power demand, current demand or input metering demand.

Demand setup menu tree
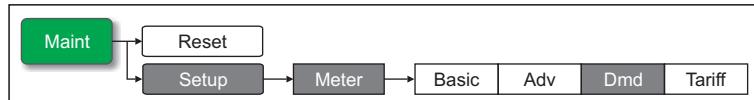
1. Navigate to **Maint > Setup**.

2. Enter the setup password (default is "0"), then press **OK**.

3. Navigate to **Meter > Dmd**.

4. Move the cursor to select **Power Demand**, **Current Demand** or **Input Demand**.

5. Move the cursor to point to the parameter you want to modify, then press **Edit**.

6. Modify the parameter as required, then press **OK**.

7. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.

Power, current, or input demand setup parameters

Parameter	Values	Description
Method	Timed Sliding Block Timed Block Timed Rolling Block Input Sync Block Input Sync Roll Block Cmd Sync Block Cmd Sync Roll Block Clock Sync Block Clock Sync Roll Block Thermal	See "Power demand" on page 115 for details.
Interval	0 - 99	Set the demand interval, in minutes.
Subinterval	0 - 99	Applies only to rolling block methods. Define how many subintervals the demand interval should be equally divided into.
Select Dig Output	None, Digital Output D1, Digital Output D2	Select which digital output the end of demand interval pulse should be sent to.
Select Dig Input	None, Digital Input S1, Digital Input S2, Digital Input S3, Digital Input S4	Applies only to input sync methods. Select which digital input is used to sync the demand.
Clock Sync Time	0 - 2359	Applies only to clock sync methods (these synchronize the demand interval to the meter's internal clock). Define what time of day you want to synchronize the demand

8. Press **Yes** to save your changes.

Related topics

- See "Power demand" on page 115 for detailed descriptions on demand parameters, characteristics and type.

Multi-tariff setup

The meter's multi-tariff feature allows you to use up to 8 different tariff "containers" to store accumulated energy data. The Tariff setup screens allow you to configure how and when to apply the different tariffs.

Related topics

- See "Multi-tariff feature" on page 105 for a comprehensive description and setup instructions using the front panel.
- To configure the tariffs using ION Setup, see the "PM5500 series" topic in the ION Setup online help or in the *ION Setup device configuration guide*, available for download at www.schneider-electric.com.

Communications setup

After wiring the meter's serial and Ethernet communications ports, you can configure these ports so you can connect to the meter remotely and use device configuration software such as ION Setup to configure the meter.

Related topics

- See "Serial communications" on page 23 for details on wiring and configuring the meter's RS-485 port.

Setting up serial communications

The Serial setup screen allows you to configure the meter's RS-485 communications port so you can use software to access the meter's data or configure the meter remotely.

Serial communications setup menu tree
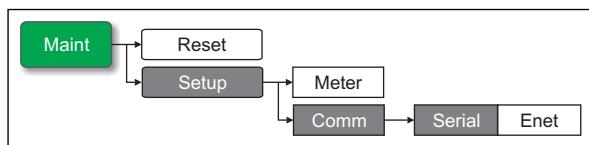
1. Navigate to **Maint > Setup**.

2. Enter the setup password (default is "0"), then press **OK**.

3. Navigate to **Comm > Serial**.

4. Move the cursor to point to the parameter you want to modify, then press **Edit**.

5. Modify the parameter as required, then press **OK**.

6. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.

RS-485 port settings

Parameter	Values	Description
Protocol	Modbus, Jbus, ASCII 8 Bit, ASCII 7 Bit	Select the communications format used to transmit data. The protocol must be the same for all devices in a communications loop.
Address	1 to 247	Set the address for this device. The address must be unique for each device in a communications loop. For Jbus protocol, set the device ID to 255.
Baud Rate	9600, 19200, 38400	Select the speed for data transmission. The baud rate must be the same for all devices in a communications loop.
Parity	Even, Odd, None	Select None if the parity bit is not used. The parity setting must be the same for all devices in a communications loop.

7. Press ▲ to exit. Press **Yes** to save your changes.

Related topics

• See "RS-485 port setup" on page 50 for instructions on configuring the RS-485 port using ION Setup.

Setting up Ethernet communications

The Ethernet setup screen allows you to assign the meter a unique IP address so you can use software to access the meter's data or configure the meter remotely through the Ethernet port. Before configuring the Ethernet parameters, make sure you obtain your meter's IP address information from your network administrator or IT department.

Ethernet communications setup menu tree
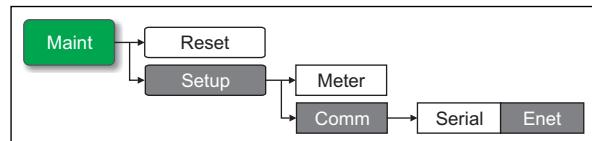
1. Navigate to **Maint > Setup**.

2. Enter the setup password (default is "0"), then press **OK**.

3. Navigate to **Comm > Enet**.

4. Move the cursor to point to the parameter you want to modify, then press **Edit**.

5. Modify the parameter as required, then press **OK**.

6. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.

Ethernet port settings

Parameter	Values	Description
IP Method	Stored, Default, DHCP, BOOTP	This controls the network protocol for your device (what the meter uses to obtain its IP address). • Stored: Use the static value programmed in the IP Address setup register • Default: Use 85.16 as the first two values of the IP address, then convert the last two hexadecimal values of the MAC address to decimal and use this as the last two values of the IP address. Example: MAC address = 00:80:67:82:B8:C8 Default IP = 85.16.184.200 • DHCP: Dynamic Host Configuration Protocol • BOOTP: Bootstrap Protocol
IP Address	Contact your local network administrator for parameter values.	The internet protocol address of your device.
Subnet		The Ethernet IP subnetwork address of your network (subnet mask).
Gateway		The Ethernet IP gateway address of your network.
HTTP Server	Enabled, Disabled	Controls whether your device's webserver and webpages are active or not.
Device Name	N/A	This parameter is read-only for reference purposes.

7. Press ▲ to exit. Press **Yes** to save your changes.

Related topics

• See "Configuring Ethernet settings using a browser" on page 56 to set up the Ethernet port using the meter webpages.

Alarms setup

An alarm is the meter's means of notifying you when an alarm condition is detected, such as an error or an event that falls outside of normal operating conditions.

Related topics

• See "Alarms" on page 89 for a comprehensive description and detailed setup instructions.

Input / output setup

The meter's input/output (I/O) ports extend the capabilities of the meter. The I/O ports can be configured using the front panel or ION Setup.

Related topics

• See "Input / Output" on page 71 for a comprehensive description and setup instructions.
• See "Specifications" on page 28 for electrical characteristics and limits of the meter's I/O ports.

HMI settings

The HMI (human-machine interface) setup screens allow you to:

• control the general appearance and behavior of the display screens,
• change the regional settings, or
• change the meter passwords.

Related topics

- To configure the front panel display using ION Setup, see the "PM5500 series" topic in the ION Setup online help or in the *ION Setup device configuration guide*, available for download at www.schneider-electric.com.

Setting up the display

You can change the display screen's contrast or the screen backlight and timeout settings.

Display setup menu tree
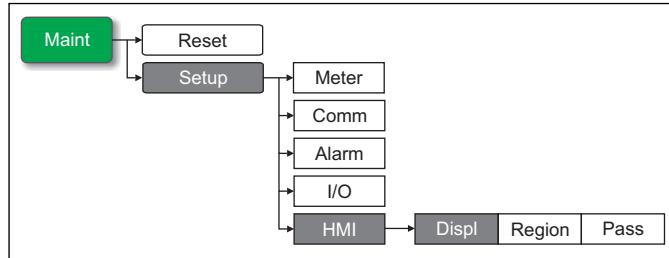
1. Navigate to **Maint > Setup**.

2. Enter the setup password (default is "0"), then press **OK**.

3. Navigate to **HMI > Disp**.

4. Move the cursor to point to the parameter you want to modify, then press **Edit**.

5. Modify the parameter as required, then press **OK**.

6. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.

Display setup parameters

Parameter	Values	Description
Contrast	1 - 9	Increase or decrease the value to increase or decrease the display contrast.
Backlight Timeout (min)	0 - 99	Set how long (in minutes) before the backlight turns off after a period of inactivity. Setting this to "0" disables the backlight timeout feature (i.e., backlight is always on).
Screen Timeout (min)	0 - 99	Set how long (in minutes) before the screen turns off after a period of inactivity. Setting this to "0" disables the screen timeout feature (i.e., display is always on).

7. Press ▲ to exit. Press **Yes** to save your changes.

Setting up regional settings

You can change the regional settings to localize the meter screens and display data in a different language, using local standards and conventions.

NOTE: In order to display a different language other than those listed in the **Language** setup parameter, you need to download the appropriate language file to the meter using the appropriate firmware upgrade tool such as DLF3000. See "Firmware upgrade" on page 126.

Regional settings menu tree
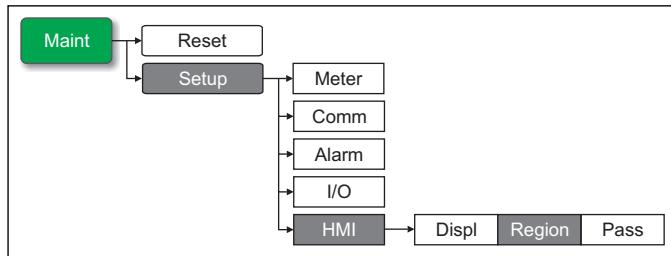
1. Navigate to **Maint > Setup**.

2. Enter the setup password (default is "0"), then press **OK**.

3. Navigate to **HMI > Region**.

4. Move the cursor to point to the parameter you want to modify, then click **Edit**.

5. Modify the parameter as required, then press **OK**.

6. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.

   Regional settings setup parameters

Parameter	Values	Description
Language	English US, French, Spanish, German, Italian, Portuguese, Chinese, Russian	Select the language you want the meter to display.
Date Format	MM/DD/YY, YY/MM/DD, DD/MM/YY	Set how you want the date to be displayed, e.g., month/day/year.
Time Format	24Hr, AM/PM	Set how you want the time to be displayed, e.g., 17:00:00 or 5:00:00 PM.
HMI Mode	IEC, IEEE	Select the standards convention used to display menu names or meter data.

7. Press ▲ to exit. Press **Yes** to save your changes.

Resetting the language

To reset the meter to the default language (English), press and hold the outermost two buttons for 5 seconds.

Setting up the screen passwords

This can only be configured through the front panel. The factory-default setting for all passwords is "0" (zero). Changing the default password for screens that are password-protected prevents unauthorized personnel from accessing certain screens such as the diagnostics and reset screens.

NOTICE

LOST DATA

Record your meter's screen password information in a secure location.

Failure to follow these instructions can result in data loss.

If you lose your password, you must return the meter for factory reconfiguration, which resets your device to its factory defaults and destroys all logged data.

Password setup menu tree
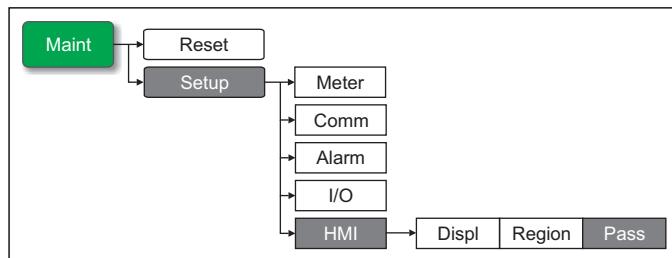
1. Navigate to **Maint > Setup**.

2. Enter the setup password (default is "0"), then press **OK**.

3. Navigate to **HMI > Pass**.

4. Move the cursor to point to the parameter you want to modify, then press **Edit**.

5. Modify the parameter as required, then press **OK**.

6. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.

Password setup parameters

Parameter	Values	Description
Setup	0000 - 9999	Sets the password for accessing the meter setup screens (Maint > Setup).
Energy Resets	0000 - 9999	Sets the password for resetting the meter's accumulated energy values.
Demand Resets	0000 - 9999	Sets the password for resetting the meter's recorded peak demand values.
Min/Max Resets	0000 - 9999	Sets the password for resetting the meter's recorded minimum and maximum values.

7. Press ▲ to exit. Press **Yes** to save your changes.

Lost password

If you lose your password, contact technical support for instructions on how to return your meter for factory reconfiguration.

- Global-PMC-Tech-support@schneider-electric.com
- (00) + 1 (250) 544-3010

NOTE: Be sure to include your power meter's serial number in your email or have it readily available when calling technical support.

Setting the clock

The Clock setup screens allow you to set the meter's date and time.

Clock setup menu tree
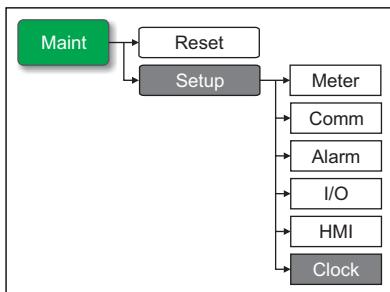
1. Navigate to **Maint > Setup**.

2. Enter the setup password (default is "0"), then press **OK**.

3. Navigate to **Clock**.

4. Move the cursor to point to the parameter you want to modify, then press **Edit**.

5. Modify the parameter as required, then press **OK**.

6. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.

Clock setup parameters

Parameter	Format	Description
Date	DD/MM/YY, MM/DD/YY, YY/MM/DD	Set the current date using the format displayed on screen, where DD = day, MM = month and YY = year.
Time	HH:MM:SS (24 hour format), HH:MM:SS AM or PM	Use the 24-hour format to set the current time (GMT or local) in hours (HH), minutes (MM) and seconds (SS).
Meter Time	GMT, Local	Select GMT if you set the current time to Greenwich Mean Time zone. Otherwise, select Local.

7. Press ▲ to exit. Press **Yes** to save your changes.

Related topics

*   See "Setting up regional settings" on page 44 for instructions on changing the format of the displayed date and time.

*   To configure the clock using ION Setup, see the "PM5500 series" topic in the ION Setup online help or in the *ION Setup device configuration guide*, available for download at www.schneider-electric.com..

*   See "TDD calculation" on page 122 for details on how the meter calculates TDD.

Setting up the alarm / energy pulsing LED

The meter's LED can be configured for alarm indication or energy pulsing.

Related topics

*   See "LED alarm indicator" on page 101 for details on setting up the LED for alarms.
*   See "Energy pulsing" on page 81 for details on setting up the LED for energy pulse counting.

Chapter 4 Remote meter setup

You can configure the meter's setup parameters through the meter's Ethernet or RS-485 communications port.

The meter is factory-configured with default Ethernet and RS-485 communications port settings. You must modify the default settings before connecting the meter to your Ethernet or RS-485 network. To do this, you need:

- a web browser to configure the Ethernet port
- ION Setup to configure the RS-485 port

NOTE: Your meter's serial communications port ID (**Com1 ID**) is used in both Ethernet and serial communications; you need to change the **Com1 ID** meter property in ION Setup if you modify the meter's RS-485 address.

Downloading ION Setup

Go to www.schneider-electric.com and search for ION Setup to download a copy of the installation file.

Upgrading ION Setup

If you already have an existing installation of ION Setup, it is recommended that you upgrade it to the latest version in order to access new ION Setup features or enhancements and properly configure features available on your device.

Refer to the online help to learn how to use ION Setup.

Ethernet port setup

Use a web browser to connect to the meter webpages and modify the default Ethernet settings before connecting the meter to your local area network (LAN). The meter is factory-configured with the following default Ethernet communications settings:

- IP address = 169.254.0.10
- Subnet mask = 255.255.0.0
- Gateway = 0.0.0.0
- HTTP server = Enabled
- Device name = PM55-xxxxxxxxxx, where xxxxxxxxxx is the meter's factory serial number (with leading zeros if serial number is less than 10 characters)
- IP method = Stored

Using a web browser to set up Ethernet

You can perform the initial configuration of your meter's Ethernet settings using the following steps.

1. Disconnect your computer from the network. If your computer has wireless communications, make sure you disable the wireless network connection as well.

2. Use an Ethernet cable to connect the computer to one of the meter's Ethernet ports.

3. Open a web browser and enter 169.254.0.10 in the address field.

4. Log in to the meter webpages. The default login values are:

   — Username = user1
   — Password = pass1

5. Click **Setup > Ethernet**.

6. Modify the Ethernet setup parameters with the settings your system administrator assigned for the meter.

   Ethernet & TCP/IP

Parameter		Description
Ethernet	MAC Address	Displays the meter's factory-programmed MAC address. This information is read-only and cannot be changed.
IP Parameters	IP Address Acquistion Mode	This controls the network protocol for your device (which the meter uses to obtain its IP address): • DHCP: Dynamic Host Configuration Protocol • BOOTp: Bootstrap Protocol • Static: Use the static value programmed in the IP Address setup register • Default: Use 85.16 as the first two values of the IP address, then convert the last two hexadecimal values of the MAC address to decimal and use this as the last two values of the IP address. Example: MAC address = 00:80:67:82:B8:C8 Default IP address = 85.16.184.200
	IP Address	The internet protocol address of your device.
	Subnet Mask	The Ethernet IP subnetwork address of your network.
	Default Gateway	The Ethernet IP gatway address of your network.

7. Click **Apply** to send and save the new settings to the meter.

8. Click **Logout** to exit the meter's webpages.

Meter setup through Ethernet

After the meter's Ethernet port is configured and connected to the LAN, you can:

• Use a web browser to connect to the meter webpages and configure Ethernet settings, webpage users and data log export schedules.

• Use ION Setup to configure all other meter setup parameters.

Related topics

RS-485 port setup

Use ION Setup to modify the meter's default RS-485 settings before connecting the meter to the RS-485 bus. The meter is factory-configured with the following default serial communications settings:

• Protocol = Modbus RTU

• Address = 1

• Baud rate = 19200

• Parity = Even

You can use a communications converter (USB to RS-485 or RS-232 to RS-485) or Ethernet gateway device to connect to the meter.

Using a serial communications converter to set up RS-485

NOTE: Configuring the serial communications settings using this method may cause ION Setup to lose communications when the changes are sent to your meter. You must reconfigure ION Setup to match the new settings to re-establish communications with your meter.

1. Configure the serial communications converter's settings to be compatible with the meter's default serial communications settings.

2. Connect the meter's RS-485 port to the serial communications converter.

3. Connect the communications converter to the computer.

4. Start ION Setup in **Network mode**.

5. Add a serial site and set its properties:

   — Comm Link = Serial
   — Comm Port = select which serial (or USB) port the communications converter is attached to
   — Baud rate = 19200
   — Format = select a format with even parity

6. Add a meter to the site and set its properties:

   — Type = PowerLogic PM5000 series Power Meter
   — Unit ID = 1

7. Use the setup screens to modify the meter's setup parameters.

8. Use the RS-485 Base Comm setup screen to modify the meter's serial communications settings.

   RS-485 port settings

Parameter	Values	Description
Protocol	Modbus RTU, JBus, ASCII 8, ASCII 7	Select the communications format used to transmit data. The protocol must be the same for all devices in a communications loop. ION Setup does not support ASCII 8 or ASCII 7 protocols.
Address	1 to 247	Set the address for this device. The address must be unique for each device in a communications loop. For JBus protocol, set the device ID to 255. This value is used in both Ethernet and serial communications; you may need to update your Ethernet settings to re-establish Ethernet communications.
Baud Rate	9600, 19200, 38400	Select the speed for data transmission. The baud rate must be the same for all devices in a communications loop.
Parity	Even, Odd, None	Select None if the parity bit is not used. The parity setting must be the same for all devices in a communications loop.

9. Click **Send** to save your changes to the meter. You need to reconfigure ION Setup to match the changed settings in order to re-establish communications with your meter.

NOTE: If you set the protocol to ASCII 7 or ASCII 8, you cannot use ION Setup to reconnect to the meter. ION Setup does not communicate using ASCII protocols.

10. Exit ION Setup.

Using an Ethernet gateway to set up RS-485

NOTE: Configuring the serial communications settings using this method may cause ION Setup to lose communications when the changes are sent to your meter. You must

reconfigure ION Setup to match the new settings to re-establish communications with your meter.

1. If applicable, disconnect all serial devices presently connected to the Ethernet gateway's RS-485 port.

2. Configure the Ethernet gateway's serial port settings to match the meter's default serial communications settings:

   — Baud rate = 19200
   — Parity = Even

3. Connect the meter's RS-485 port to the Ethernet gateway.

4. Connect the Ethernet gateway to the LAN.

5. Start ION Setup in **Network mode**.

6. Add an Ethernet gateway site and set its properties:

   — IP address = IP address of the Ethernet gateway
   — Port = 502 (for Modbus RTU)

7. Add a meter to the site and set its properties:

   — Type = PowerLogic PM5000 series Power Meter
   — Unit ID = 1

8. Use the RS-485 Base Comm setup screen to modify the meter's serial communications settings.

   RS-485 port settings

Parameter	Values	Description
Protocol	Modbus RTU, JBus, ASCII 8, ASCII 7	Select the communications format used to transmit data. The protocol must be the same for all devices in a communications loop. ION Setup does not support ASCII 8 or ASCII 7 protocols.
Address	1 to 247	Set the address for this device. The address must be unique for each device in a communications loop. For JBus protocol, set the device ID to 255. This value is used in both Ethernet and serial communications; if you change this value, you need to update your meter properties in ION Setup to re-establish Ethernet communications.
Baud Rate	9600, 19200, 38400	Select the speed for data transmission. The baud rate must be the same for all devices in a communications loop.
Parity	Even, Odd, None	Select None if the parity bit is not used. The parity setting must be the same for all devices in a communications loop.

9. Click **Send** to save your changes to the meter. You need to reconfigure ION Setup to match the changed settings in order to re-establish communications with your meter.

NOTE: If you set the protocol to ASCII 7 or ASCII 8, you cannot use ION Setup to reconnect to the meter. ION Setup does not communicate using ASCII protocols.

10. Exit ION Setup.

Meter setup through RS-485

After the meter's RS-485 port is configured and connected to the RS-485 network, you can use ION Setup to configure all other meter setup parameters.

Related topics

- See "Setting up serial communications" on page 41 for details on using the meter's display panel to configure the RS-485 port.

Meter configuration using ION Setup

Start ION Setup, create a site (or if applicable, use an existing site), then add your meter to the site.

NOTE: When adding your meter as an Ethernet device, make sure you enter the meter's address in the **Com1 ID** field.

See the "PM5500 series" topic in the ION Setup online help or in the *ION Setup device configuration guide*. To download a copy, go to www.schneider-electric.com and search for ION Setup device configuration guide.

Related topics

- See "Front panel display and meter setup" on page 33 to configure the meter using the display panel.

Chapter 5   Meter webpages

This section describes the meter's webpages. The meter's Ethernet connection allows you to access the meter so you can view data and perform some basic configuration and data export tasks using a web browser.

Accessing the meter webpages

Open a web browser and enter the meter's IP address in the address box. When prompted, enter your username and password.

NOTE: The webpages are accessed through the meter's Ethernet port so it must be configured properly. See "Configuring Ethernet settings using a browser" on page 56 for instructions on changing the factory default Ethernet settings.

Webpage UI overview

The meter webpages contain typical elements as shown below.
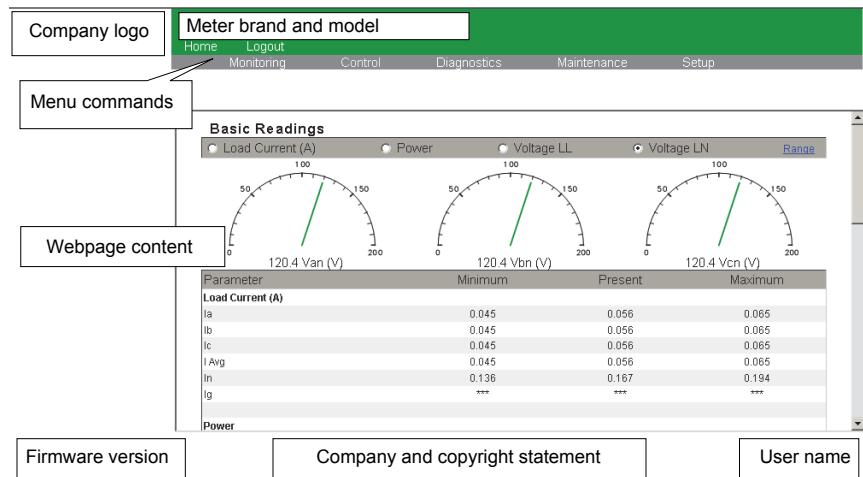
Webpages setup

You can configure the Ethernet port, user names and passwords, and device log exports through the webpages' **Setup** menu.

Ethernet communications settings

The meter is factory-configured with default Ethernet settings. You must change the default settings before connecting the meter to your network.

Configuring Ethernet settings using a browser

Before connecting the meter to your LAN, you must first configure the Ethernet settings.

Initial Ethernet configuration steps

1. Disconnect your computer from the network. If your computer has wireless communications, make sure you disable the wireless network connection as well.

2. Use an Ethernet cable to connect the computer to one of the meter's Ethernet ports.

3. Open a web browser and enter 169.254.0.10 in the address box.

4. Log in to the meter webpages. The default login is:
   — Username = user1
   — Password = pass1

5. Click **Setup > Ethernet**.

6. Modify the Ethernet setup parameters with the settings your system administrator assigned for the meter, then press **Apply**.

   Ethernet & TCP/IP

Parameter		Description
Ethernet	MAC Address	Displays the meter's factory-programmed MAC address. This information is read-only and cannot be changed.
IP Parameters	IP Address Acquistion Mode	This controls the network protocol for your device (which the meter uses to obtain its IP address): • DHCP: Dynamic Host Configuration Protocol[1] • BOOTp: Bootstrap Protocol • Static: Use the static value programmed in the IP Address setup register • Default: Use 85.16 as the first two values of the IP address, then convert the last two hexadecimal values of the MAC address to decimal and use this as the last two values of the IP address. Example: MAC address = 00:80:67:82:B8:C8 Default IP = 85.16.184.200
	IP Address	The internet protocol address of your device.
	Subnet Mask	The Ethernet IP subnetwork address of your network (subnet mask).
	Default Gateway	The Ethernet IP gatway address of your network.

   [1] FQDN (fully qualified device name) is not supported. The device name is not automatically sent to a DNS server when a DHCP request is sent. In order to use device name instead of IP address, your IT administrator must manually add the device name to the DNS.

7. Press **Apply** to send and save the new settings to the meter.

8. Disconnect the meter from the computer.

Final Ethernet configuration steps

1. Re-establish the the computer's connection to your LAN (plug the computer's Ethernet cable back to your LAN connection or re-enable wireless communications to the LAN).

2. Connect the meter's Ethernet port to your LAN.

3. Open a web browser and enter the meter's IP address in the address box.

4. Log in to the meter webpages.

Configuring Ethernet settings using the front panel

User setup

To set up users for the webpages:

1. Click **Setup > User**.

2. Configure the parameters as appropriate.

User Accounts

Parameter	Description
Name	Lists the current usernames for accessing the meter. You can add a new user by typing the username in a blank cell. To remove an existing user, select the name and press **Delete** on your keyboard.
Password[1]	Lists the current password associated with each user. After adding a new username, you can type a password to associate it with the username. As you enter characters for your password, the status bar changes to indicate the password strength (weak, medium, strong or very strong).
Group	Select the group the username belongs to (e.g., web user or product master).
Language	Select the language the webpages are displayed in for the selected username.

[1]   Always record changes or additions to the username and password list and store the list in a safe place.

3. Click **Apply** to send and save the new settings to the meter.

Device log export setup

You can set up the meter to export its logs to a web server.

NOTE: Device log export times can vary exponentially, depending on the number of records to export. To avoid long log export times, consider reducing the logging frequency for the recorded items or selecting a more frequent log export schedule (e.g., weekly instead of monthly).

1. Click **Setup > Device Log Export**.

2. Make sure that the **Transport** setting is enabled (e.g., set to **HTTP**). Configure the parameters as appropriate.

Device Log Export

Parameter	Values	Description
Transport	Disabled, HTTP	Select **Disabled** to disable exporting of meter data logs, or select **HTTP** to enable exporting of meter data logs.
Schedule	Daily, Weekly, Monthly	Select **Daily** to set the meter data log export to once a day. Use the **Time of Day** field to select what time the data log export occurs each day. Select **Weekly** to set the meter data log export to once a week. Use the **Time of Day** and **Day of Week** fields to select what time and day the data log export occurs each week. Select **Monthly** to set the meter data log export to once a month. Use the **Time of Day** and **Day of Month** fields to select what time and day the data log export occurs each month.
HTTP Parameters	Server IP Address	Enter the IP address of the server for the data log export.
	Server TCP Port	Enter the server port number for HTTP communications.
	Proxy Server IP Address	Enter the proxy server IP address.
	Proxy Server TCP Port	Enter the proxy server TCP port number.
	PATH	Enter the network path of the folder where the data logs are to be exported.
	Field Name	Enter the name of the exported data log.
	Host Name	If using a virtual host name, enter the name here.
	Username	Enter the username for accessing the server.
	Password	Enter the password for accessing the server.

3. Click **Apply** to send and save the new settings to the meter.

NOTE: You can use the **Test HTTP** button to test the meter connection to the web server.

Related topics

• See "Meter logging" on page 61 for information on what data the meter records.

Viewing the meter webpages

1. Start a web browser and enter the meter's IP address. When prompted, enter your username and password. The default login is:

    — Username = user1
    — Password = pass1

2. Use the menus along the top banner to select and display the meter's various webpages.

NOTE: Click **Home** to go to the page that is configured as the meter's homepage (e.g., **Monitoring > Basic Readings**).

Monitoring

This menu allows you to navigate to the following webpages:

• Basic Readings
• Power Quality
• Active Alarms
• Alarm History
• Inputs/Outputs
• Data Log

Setting the measurement range

Click **Range** to set the minimum and maximum ratings (limits) for current, power and voltage (L-L and L-N). Select **Enable Auto Scale** to automatically set the scale on the graphical (dial) indicators.

Basic Readings

Parameter	Description
Load Current	Real-time load current per phase (Ia, Ib, Ic) and average (I Avg), neutral (In) and residual/ground current (Ig), and minimum and maximum recorded values.
Power	Real (kW), reactive (kVAR) and apparent (kVA) power, minimum and maximum recorded values.
Power Factor Total	Real-time power factor (lead or lag), minimum and maximum recorded values.
Voltage	Real-time line-to-line voltage (Vab, Vbc, Vca) and average (VLL Avg), line-to-neutral voltage (Van, Van, Vcn) and average (VLN Avg).
Frequency	Real-time frequency, minimum and maximum recorded values
Demand Current	Real-time current demand per phase (Ia, Ib, Ic), demand last interval, peak demand with date and timestamp, and the date and time when demand values were last reset.
Demand Power	Real-time real (kW), reactive (kVAR) and apparent (kVA) power demand.
Energy	Accumulated values for delivered and received real energy (kWh), reactive energy (kVARh) and apparent energy (kVAh), and the date and time when energy values were last reset.

Power Quality

Parameter	Description
THD Current	Percent total harmonic distortion for each phase current and neutral.
Current Unbalance	Percent current unbalance per phase and worst recorded unbalance.
THD VL-L	Percent total harmonic distortion for each line-to-line phase voltage.
VL-L Unbalance	Percent voltage unbalance for each line-to-line phase voltage and worst recorded voltage unbalance.
THD VL-N	Percent total harmonic distortion for each line-to-neutral phase voltage.
VL-N Unbalance	Percent voltage unbalance for each line-to-neutral phase voltage and worst recorded voltage unbalance.

Active Alarms

Parameter	Description
Event[1]	This is a list of active (unacknowledged) alarm events with a date/timestamp for each event, the value that triggered the alarm (e.g., pickup) and a description of the event type.

[1] Click the event number to display additional details about the alarm, for example, the actual pickup or dropout value and which phase the alarm condition occurred.

Alarm History

Parameter	Description
Event[1]	This is a historical list of (acknowledged) alarm events with a date/timestamp for each event, the value that triggered the alarm (e.g., pickup) and a description of the event type.

[1] Click the event number to display additional details about the alarm, for example, the actual pickup or dropout value and which phase the alarm condition occurred.

Inputs / Outputs

Parameter	Description
Inputs	Displays the current status of the digital inputs.
Outputs	Displays the current status of the digital outputs.

Data Log

Description
A list of timestamped data recorded in the meter's data log (energy delivered in Wh, VARh and VAh).

Diagnostics

This menu allows you to navigate to the **Meter** and **Communications** webpages.

Meter

This webpage contains information about the meter:

- **Meter Information** displays the meter model, serial number and manufacture date.
- **Firmware Version** displays the version numbers of the installed firmware (OS, RS, Ethernet, Language and FPGA).

Communications

This webpage displays the meter's current time and the meter's last boot time.

This webpage also contains diagnostics information for Ethernet, HTTP server, HTTP client and Modbus server. This data aids in troubleshooting communications.

Click **Reset** to clear the stored information on this page.

Maintenance

This menu allows you to navigate to the **Registers** and **Maintenance Log** webpages.

Registers

The **Read Device Registers** page allows you to access the meter and read a specified block of Modbus registers:

1. Enter values in the **Starting Register** and **Number of Registers** fields.

2. Select the number format of the registers: Decimal, Hexadecimal, Binary, ASCII or Float.

3. Click **Read**.

Maintenance Log

The **Maintenance Log** page displays a record of meter events, and in particular, changes to meter setup. Each event is date/timestamped. The **Value** field shows a brief description what changed and the **Event Type** specifies which area of the meter was affected.

Related topics

- Go to www.schneider-electric.com and search for your meter's Modbus register list to download a copy.

Exporting data logs

See "Device log export setup" on page 57 for details on configuring the meter to perform regular data log exports according to a set schedule. To export the meter data logs manually, click **Manual Export**.

Logging out

Click **Logout** to exit the meter webpages.

Chapter 6   Meter logging

This section describes the meter's logging feature. Meter data and events are stored in these logs:

- Data log
- Alarm log
- Maintenance log

Data log

The meter is shipped from the factory with data logging enabled for selected values. Typically, delivered energy (kWh, kVARh and kVAh) is logged by default, but you can configure the meter to record other measurements.

Setting up the data log

Use ION Setup to configure data logging. You can select up to 14 items to record in the data log and the frequency (logging interval) that you want those values updated.

NOTICE
LOST DATA
Save the contents of the data log before configuring it.
Failure to follow these instructions can result in data loss.

1. Start ION Setup and open your meter in setup screens mode (**View > Setup Screens**). See the ION Setup Help for instructions.

2. Double-click **Data Log #1**.

3. Set up the logging frequency and measurements/data to log.

   Data Log #1 setup parameters

Parameter	Values	Description
Status	Enable, Disable	Set this parameter to enable or disable data logging in the meter.
Interval	1 minute, 5 minutes, 10 minutes, 15 minutes, 30 minutes, 1 hour, 24 hours	Select a time value to set the logging frequency.
Channels	Items available for logging can vary based on the meter type.	Select an item to record from the "Available" column, then click the double-right arrow button to move the item to the "Selected" column. To remove an item, select it from the "Selected" column then click the double-left arrow button.

4. Click **OK**, then **Send** to save the changes to the meter.

Saving the data log contents

You can use ION Setup or the meter webpages to save the contents of the data log.

Data log export using ION Setup

1. Start ION Setup and open your meter in data screens mode (**View > Data Screens**). See the ION Setup Help for instructions.

2. Double-click **Data Log #1** to retrieve the records.

3. Once the records have finished uploading, right-click anywhere on the viewer and select **Export CSV** from the popup menu to export the entire log.

   NOTE: To export only selected records in the log, click the first record you want to export, hold down the SHIFT key and click the last record you want to export, then select **Export CSV** from the popup menu.

4. Navigate to the folder where you want to save the data log file, then click **Save**.

Data log export using a web browser

See "Device log export setup" on page 57 for instructions on saving the data log from the webpages.

Alarm log

Alarm records are stored in the meter's alarm history log. You can use the meter's display or a web browser to view the alarm history log.

Related topics

- See "Active alarms list and alarm history log" on page 104 to view the alarm records using the meter's display.
- See "Viewing the meter webpages" on page 58 to view the alarm records using a web browser.

Maintenance log

The meter records maintenance-type events such as changes to meter setup. You can use a web browser to view the contents of the maintenance log.

Related topics

- See "Viewing the meter webpages" on page 58 to view the maintenance log using a web browser.

Chapter 7   Viewing meter data

You can view meter data from the meter's front panel display, a web browser, or through software.

Viewing meter data from the front panel

This section applies to meters that are equipped with a front panel display.

The Summary screen displays real-time values for average voltage and current (Vavg, Iavg), total power (Ptot) and energy consumption (E Del).

Summary screen

A	Menu selection buttons
B	Scroll right navigation button
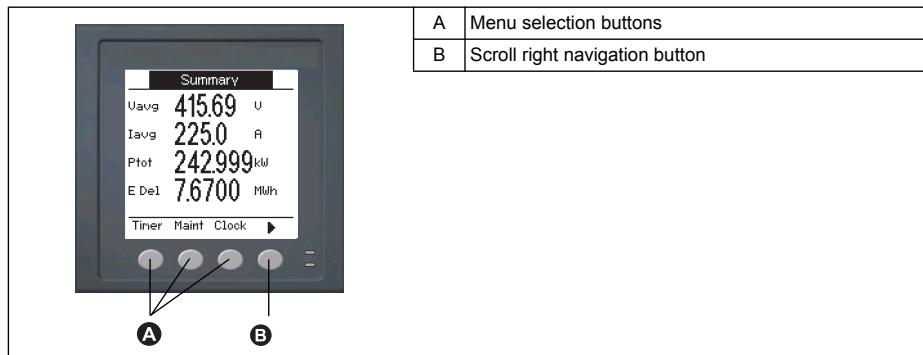
Displaying data screens

To display data screens, press the button below the appropriate menu. To see more menu items, press the ▶ navigation button.

Related topics

- See "Front panel display and meter setup" on page 33 for information on front panel menu navigation, LED indicators and display screen notification icons.
- See "Remote meter setup" on page 49 for information on communications port setup using the meter webpages and meter configuration using ION Setup.
- See "Alarms" on page 89 for information on alarm indicators and the alarm notification icon.
- See "Maintenance and upgrades" on page 125 for information on the wrench (maintenance) icon and troubleshooting abnormal LED behavior.

Meter data display screens

The screen menu items are listed below. The titles listed are for the HMI mode in IEEE, with the corresponding titles in IEC mode in square brackets [ ].

Related topics

- See "Setting up regional settings" on page 44 for details on changing the HMI mode.

Current
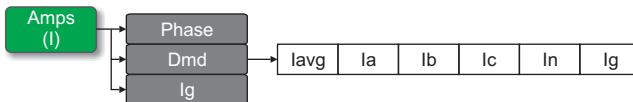
Amps [I]

Phase			Instantaneous current measurements for each phase and neutral (Ia [I1], Ib [I2], Ic [I3], In).
Dmd			Summary of peak current demand values at the last demand interval for each phase and neutral (Ia [I1], Ib [I2], Ic [I3], In).
	Iavg, Ia [I1], Ib [I2], Ic [I3], In, Ig		Real-time demand (Pres), peak demand (Peak) and predicted demand (Pred) for the present interval. Average demand for the previous (Last) interval.
		Pk DT	Date and timestamp for the peak demand readings.
Ig			Average (Iavg), neutral (In) and residual/ground (Ig) current

Related topics

- See "Current demand" on page 117.

Voltage
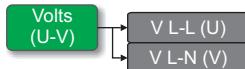
Volts [U-V]

V L-L [U]	Line-to-line phase voltage (Vab [U12], Vbc [U23], Vca [U31]).
V L-N [V]	Line-to-neutral phase voltage (Van [V1], Vbn [V2]), Vcn [V3]).

Harmonics

Harm

V L-L [U]		Line-to-line voltage harmonics data: Numeric magnitude and angle for the fundamental harmonic, and graphical representation of harmonics for the 3rd to 11th, 13th to 21st, and 23rd to 31st odd harmonics for each line-to-line phase voltage (Vab [U12], Vbc [U23], Vca [U31]).
	Fund, 3-11, 13-21, 23-31	
V L-N [V]		Line-to-neutral voltage harmonics data: Numeric magnitude and angle for the fundamental harmonic, and graphical representation of harmonics for the 3rd to 11th, 13th to 21st, and 23rd to 31st odd harmonics for each line-to-neutral phase voltage (Van [V1], Vbn [V2]), Vcn [V3]).
	Fund, 3-11, 13-21, 23-31	
Amps [I]		Current harmonics data: Numeric magnitude and angle for the fundamental harmonics, and graphical representation of harmonics for the 3rd to 11th, 13th to 21st, and 23rd to 31st odd harmonics for each phase current (Ia [I1], Ib [I2], Ic [I3]).
	Fund, 3-11, 13-21, 23-31	
TDD/K		Total demand distortion and K-factor data for each phase voltage (K-F A [K-F 1], .K-F B [K-F 2], K-F C [K-F 3]).
Crest		Crest factor data for each phase current (Ia [I1], Ib [I2], Ic [I3]), line-to-line phase voltage (Vab [U12], Vbc [U23], Vca [U31]), and line-to-neutral phase voltage (Van [V1], Vbn [V2]), Vcn [V3]).
	Amps [I], V L-L [U], V L-N [V]	

Related topics

- See "Power quality" on page 121.

Power

Power (PQS)	Power (PQS)			
	Phase			
	Dmd			

Active (P)	Reac (Q)	Appr (S)	
Wd (Pd)	Tot	A	B	C
VARd (Qd)	Tot	A	B	C
VAd (Sd)	Tot	A	B	C

Power [PQS]

Power [PQS]			Summary of real-time power consumption values for total active power in kW (Total [Ptot]), total reactive power in kVAR (Total [Qtot]), and total apparent power in kVA (Total [Stot]).
Phase			Per phase and total power values for active power in kW (A [P1], B [P2], C [P3], Total [Ptpt]), reactive power in kVAR (A [Q1], B [Q2], C [Q3], Total [Qtot]) and apparent power in kVA (A [S1], B [S2], C [S3], Total [Stot]).
	Active [P], Reac [Q], Appr [S]		
Dmd			Summary of peak power demand values in the previous (Last) demand interval period for active power in kW, reactive power in kVAR and apparent power in kVA.
	Wd [Pd], VARd [Qd], VAd [Sd]		Total and per phase peak power demand values in the previous (Last) demand interval for active power demand (Wd [P]), reactive power demand (VARd [Q]) and apparent power demand (VAd [S]).
		Tot, A [1], B [2], C [3]	For the selected power demand screen (active, reactive or apparent), each of these sub-screens (total and per phase demand) display demand values for the present demand (Pres) interval, predicted demand (Pred) based on the current power consumption rate, demand for the previous demand (Last) interval period, and recorded peak power demand (Peak) value.
		Pk DT	Date and timestamp for the peak power demand (Peak) value.

Related topics

- See "Power demand" on page 115.

Energy

Energy (E)	Wh							
	VAh							
	VARh							
	Tariff	T1	T2	T3	T4	T5	T6	T7	T8
	Inp Mtr	Dmd	Ch 1	Ch 2	Ch 3	Ch 4		
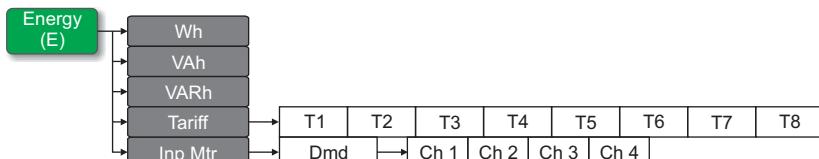
Energy [E]

Wh			Delivered (Del), received (Rec), delivered plus received (D+R) and delivered minus received (D-R) accumulated values for active energy (Wh), apparent energy (VAh) and reactive energy (VARh).
VAh			
VARh			
Tariff			Displays the available tariffs (T1 through T8).
	T1, T2, T3, T4, T5, T6, T7, T8		
		Del	Active energy delivered in Wh (W [P]), reactive energy delivered in VARh (VAR [Q]) and apparent energy delivered in VAh (VA [S]) energy for the selected tariff.
		Rec	Active energy received in Wh (W [P]), reactive energy received in VARh (VAR [Q]) and apparent energy received in VAh (VA [S]) energy for the selected tariff
		InMet	Accumulated values on the input metering channels (Ch 1 to Ch 4) for the selected tariff.
Inp Mtr			Accumulated values on the input metering channels (Ch 1 to Ch 4).
	Dmd		Summary of demand values for input metering channels Ch 1 to Ch 4 in the previous (Last) demand interval.
		Ch 1, Ch 2, Ch 3, Ch 4	Demand values for present (Pres) and previous (Last) interval periods, predicted demand (Pred) based on the current consumption rate, and recorded peak demand (Peak) value for the selected input metering channel.
		Pk DT	Date and timestamp for the peak demand reading.

Related topics

*   See "Multi-tariff feature" on page 105.

Power Factor
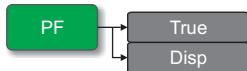
PF

True	True power factor values per phase and total (PFa [PF1], PFb [PF2], PFc [PF3], Total), PF sign, and load type (capacitive = lead, inductive = lag).
Disp	Displacement power factor values per phase and total (PFa [PF1], PFb [PF2], PFc [PF3],, Total), PF sign, and load type (capacitive = lead, inductive = lag).

Frequency

Hz [F]

Frequency (Freq), average voltage (Vavg), average current (Iavg) and total power factor (PF) values.

Total harmonic distortion
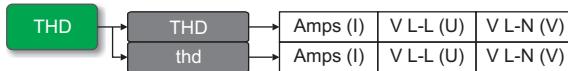
THD

THD		THD (ratio of harmonic content to the fundamental) for phase currents (Ia [I1], Ib [I2], Ic [I3], In), line-to-line voltages(Vab [U12], Vbc [U23], Vca [U31]) and line-to-neutral voltages (Van [V1], Vbn [V2], Vcn [V3]).
	Amps [I], V L-L [U], V L-N [V]	
thd		thd (ratio of harmonic content to the rms value of total harmonic content) phase currents (Ia [I1], Ib [I2], Ic [I3], In), line-to-line voltages(Vab [U12], Vbc [U23], Vca [U31]) and line-to-neutral voltages (Van [V1], Vbn [V2], Vcn [V3]).
	Amps [I], V L-L [U], V L-N [V]	

Related topics

*   See "Power quality" on page 121.

Unbalance

Unbal

Percent unbalance readings for line-to-line voltage (V L-L [U]), line-to-neutral voltage (V L-N [V]) and current (Amps [I]).

Minimum / maximum
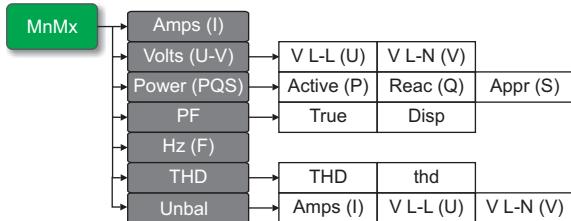
MnMx

MnMx			Summary of maximum values for line-to-line voltage, line-to-neutral voltage, phase current and total power.
	Amps [I]		Minimum and maximum values for phase current.
	Volts [U-V]		Minimum and maximum values for line-to-line voltage and line-to-neutral voltage.
		V L-L [U], V L-N [V]	
	Power [PQS]		Minimum and maximum values for active, reactive, and apparent power.
		Active [P], Reac [Q], Appr [S]	
	PF		Minimum and maximum values for true and displacement PF and PF sign.
		True, Disp	
	Hz [F]		Minimum and maximum values for frequency.
	THD		Minimum and maximum values for total harmonic distortion (THD or thd).
		THD, thd	
			Amps [I], V L-L [U], V L-N [V] — THD or thd minimum and maximum values for phase or neutral current, line-to-line voltage and line-to-neutral voltage.
	Unbal		Minimum and maximum values for current unbalance, line-to-line voltage unbalance and line-to-neutral voltage unbalance.
		Amps [I], V L-L [U], V L-N [V]	
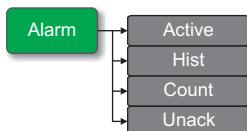
Alarm

Alarm

Active	Lists all active alarms (Active), past alarms (Hist), the total number each standard alarm has been tripped (Count), and all unacknowledged alarms (Unack).
Hist	
Count	
Unack	

Related topics

- See "Alarms" on page 89.

Input / Output
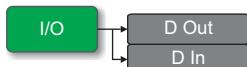
I/O

D Out	Current status (on or off) of the selected digital output or digital input. Counter shows the total number of times an off-to-on change of state is detected. Timer shows the total time (in seconds) that a digital input or digital output is in the on state.
D In	

Related topics

- See "Input / Output" on page 71.

Timer
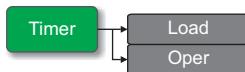
Timer

Load	Real-time counter that keeps track of the total number of days, hours, minutes and seconds an active load is connected to the meter inputs.
Oper	Real-time counter for the total number of days, hours, minutes and seconds the meter has been powered.

Related topics

Maintenance

Maint

Reset			Screens to perform global or single resets.
Setup			Meter configuration screens.
	Meter		
		Basic, Adv, Dmd, Tariff	Basic: screens to define the power system and power system components/elements.
			Adv: screens to set up the active load timer and define the peak demand current for inclusion in TDD calculations.
			Dmd: screens to set up power demand, current demand and input metering demand.
			Tariff: screens to set up tariffs.
	Comm		Screens to set up serial and Ethernet communications.
		Serial, Enet	
	Alarm		Screens to set up standard (1-Sec), unary, digital, logic and custom (Cust1s) alarms.
		1-Sec, Unary, Dig, Logic, Cust1s	
	I/O		Screens to set up the alarm / energy pulsing LED, digital inputs, digital outputs and input metering channels.
		LED, D In, D Out, Inp Mtr	
	HMI		Screens to configure display settings, edit regional settings and set up front panel meter access passwords.
		Displ, Region, Pass,	
	Clock		Screens to set up the meter date and time.
Diag			Diagnostic screens provide meter information for troubleshooting.
	Info		Model, serial number, manufacture date, OS, RS and language versions.
	Meter		Displays the meter status.
	Cl_Power		Displays how many times the meter lost control power, and the date and time of its last occurrence.

Maint (Continued)

Phasor		Displays a graphical representation of the power system the meter is monitoring,.
	Polar	Displays the numeric magnitude and angles of all voltage and current phases.

Related topics

- See "Meter resets" on page 85.
- See "Front panel meter setup" on page 37.
- See "Maintenance and upgrades" on page 125.

Clock

Clock

Clock

Meter date and time (local or GMT).

Viewing meter data from a web browser

You can use a web browser to access the meter webpages and configure the Ethernet port, view or export logged meter data, read the contents of the meter registers, and view real-time meter data. See "Meter webpages" on page 55.

Using ION Setup to view or modify configuration data

You can use ION Setup to view or modify the meter setup parameters. See "Meter configuration using ION Setup" on page 53.

Using software to view meter data

There are different software systems and methods you can use to access or display the meter data. This can range from using a simple Modbus register interface to read stored values in the meter's registers, to viewing intelligent information from the meter through an energy management system.

Power Monitoring Expert

StruxureWare™ Power Monitoring Expert is a complete supervisory software package for power management applications. The software collects and organizes data gathered from your facility's electrical network and presents it as meaningful, actionable information via an intuitive web interface.

See the Power Monitoring Expert online help for instructions on how to add your meter to the system. Power Monitoring Expert communicates with devices on the network to provide:

- Real-time monitoring through a multi-user web portal
- Trend graphing and aggregation
- Power quality analysis and compliance monitoring
- Preconfigured and custom reporting

Related topics

- See the StruxureWare Power Monitoring Expert online help for instructions on how to add your meter into its system for data collection and analysis.
- StruxureWare Power Monitoring Expert user documentation is available in PDF format and can be downloaded from www.schneider-electric.com.

PowerSCADA Expert

StruxureWare™ PowerSCADA Expert is a complete real-time monitoring and control solution for large facility and critical infrastructure operations. It communicates with your meter for data acquisition and real-time control.

You can use PowerSCADA Expert for:

- System supervision and alarm management
- Real-time and historical trending, event logging and waveform capture
- PC-based custom alarms

Related topics

- See the StruxureWare PowerSCADA Expert online help for instructions on how to add your meter into its system for data collection and analysis.
- StruxureWare PowerSCADA Expert user documentation is available in PDF format and can be downloaded from www.schneider-electric.com.

Modbus command interface

Most of the meter's real-time and logged data, as well as basic configuration and setup of meter features, can be accessed and programmed using a Modbus command interface and the meter's Modbus register list. This is an advanced procedure that should only be performed by users with advanced knowledge of Modbus, their meter, and the power system being monitored. For further information on the Modbus command interface, contact Technical Support.

Related topics

- See your meter's Modbus register list at www.schneider-electric.com for the Modbus mapping information and basic instructions on command interface.

Chapter 8   Input / Output

This section describes the meter's I/O (input/output) features.

The meter is equipped with:

- four (4) digital input ports (S1 to S4), and
- two (2) Form A digital output ports (D1 and D2).

After you wire the meter's digital I/O ports, you can configure these ports so you can use the meter to perform I/O functions.

Digital input applications

Digital inputs are typically used for monitoring the status of external contacts or circuit breakers. They can also be used for pulse counting or input metering applications, such as WAGES (water, air, gas, electricity, steam) monitoring.

The meter's digital inputs require an external voltage source to detect the digital input's on/off state. The meter detects an on state if the external voltage appearing at the digital input is within its operating range.

> ## ⚠ DANGER
>
> **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**
>
> - Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA or applicable local standards.
> - Turn off all power supplying this device before working on it.
> - Always use a properly rated voltage sensing device to confirm that all power is off.
> - Do not exceed the device's ratings for maximum limits.
> - Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.
>
> **Failure to follow these instructions will result in death or serious injury.**

Wiring the digital inputs
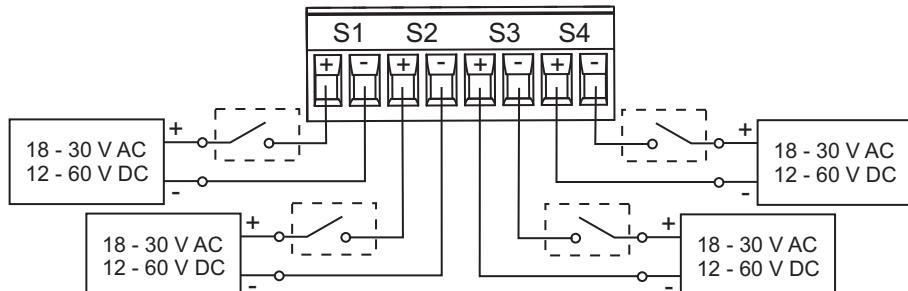
Related topics

- See "Specifications" on page 28 for electrical characteristics and limits for the digital inputs.

WAGES monitoring

WAGES monitoring allows you to record and analyze all energy sources and utilities usage.

Your energy system may use several different types of energy. For example, you may consume steam or compressed air for industrial processes, electricity for lights and computers, water for cooling and natural gas for heating. WAGES monitoring collects the usage information from all these different energy sources to enable a more complete energy analysis.

WAGES information can help you:

- Identify losses or inefficiencies.
- Modify demand to reduce costs.
- Optimize energy source usage.

WAGES application example

You can connect your meter's digital input to a transducer that sends a pulse for every 15 liters of water. After configuring an input metering channel and assigning it to the digital input, the meter is able to detect and record the incoming pulses. An energy management system can then use the information from the meter to perform WAGES analysis.
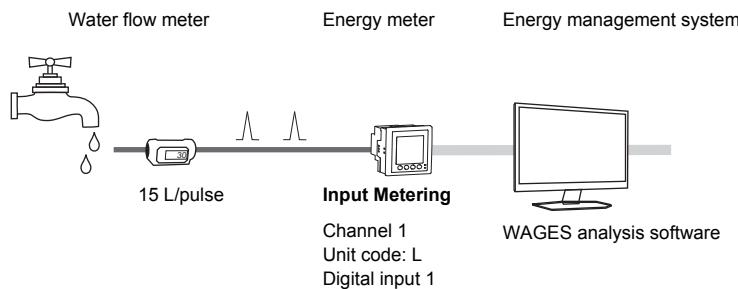
Water flow meter   Energy meter   Energy management system

15 L/pulse

Input Metering

Channel 1
Unit code: L
Digital input 1

WAGES analysis software

Related topics

Digital input setup

The digital input ports (S1 to S4) can be configured using the front panel or ION Setup software.

NOTE: It is recommended you use ION Setup to configure the digital inputs, as setup parameters that require text entry can only be modified using ION Setup.

Configuring digital inputs using ION Setup

You can use ION Setup to configure the digital inputs.

1. Start ION Setup.
2. Connect to your meter.
3. Navigate to **I/O configuration** > **I/O Setup**.
4. Select a digital input to configure and click **Edit**. The setup screen for that digital input is displayed.
5. Enter a descriptive name for the digital input's **Label**.

6. Configure the other setup parameters as required.

7. Click **Send** to save your changes.

Digital input setup parameters available through ION Setup

Parameter	Values	Description
Label	—	Use this field to change the default label and assign a descriptive name to this digital input.
Control Mode	Normal, Demand Sync, Input Metering	This field displays how the digital input functions. • Normal: the digital input is not associated with another meter function. The meter counts and records the number of incoming pulses normally. • Demand Sync: the digital input is associated with one of the input sync demand functions. The meter uses the incoming pulse to synchronize its demand period with the external source. • Input Metering: the digital input is associated with one of the input metering channels. The meter counts and records the number of incoming pulses and related consumption data associated with the pulses.
Debounce	0 to 9999	Debounce is the time delay that compensates for mechanical contact bounce. Use this field to set how long (in milliseconds) the external signal must remain in a certain state to be considered a valid state change.
Associations	—	This field displays additional information if the digital input is already associated with another meter function.

Configuring digital inputs using the front panel

You can use the front panel to configure the digital inputs.

Digital input setup menu tree
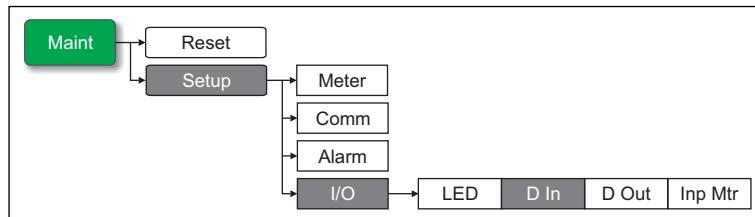
1. Navigate to **Maint > Setup**.

2. Enter the setup password (default is "0"), then press **OK**.

3. Navigate to **I/O > D In**.

4. Move the cursor to point to the digital input you want to set up, then press **Edit**.

5. Move the cursor to point to the parameter you want to modify, then press **Edit**.

   NOTE: If **Edit** is not displayed, it means the parameter is either read-only or can only be modified through software.

6. Modify the parameter as required, then press **OK**.

   Digital input setup parameters available through the front panel

Parameter	Values	Description
Label	—	This can be modified only through software. Use this field to assign names to the digital inputs (S1 to S4).

Digital input setup parameters available through the front panel (Continued)

Parameter	Values	Description
Debounce Time (ms)	0 to 9999	Debounce is the time delay that compensates for mechanical contact bounce. Use this field to set how long (in milliseconds) the external signal must remain in a certain state to be considered a valid state change.
Control Mode	Normal, Demand Sync, Input Metering	This field displays how the digital input functions. • Normal: the digital input is not associated with another meter function. The meter counts and records the number of incoming pulses normally. • Demand Sync: the digital input is associated with one of the input sync demand functions. The meter uses the incoming pulse to synchronize its demand period with the external source. • Input Metering: the digital input is associated with one of the input metering channels. The meter counts and records the number of incoming pulses and related consumption data associated with the pulses.

7. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.

8. Press ▲ to exit. Press **Yes** to save your changes.

Related topics

- See "Synchronized demand" on page 116 for information on using an external source to synchronize meter demand periods.
- See "Input metering setup" on page 75 for details on associating a digital input for input metering applications.

Input metering

Your meter's digital inputs can be used to count pulses from transducers and convert the pulses to energy measurements.

Your meter's input metering channels count pulses received from the digital inputs assigned to that channel. The incoming pulses are used in calculating and measuring consumption data (e.g., BTU, kWh, L, kg). Each channel must have the following values configured to match the pulse data:

- Pulse Weight: the pulses per unit value.
- Unit Code: the unit of measure associated with the monitored value.
- Demand Code: for time-based values (such as kWh), this provides the associated demand units (kW) for demand calculations; for other values (such as kg), this can be configured to provide rate information (kg/h or kg/s).
- Mode: Whether pulse counting based on full pulses or transitions.

For example, if each complete pulse represents 125 Wh, you can configure for Wh pulsing as follows:

- Pulse Weight = pulses/Wh = 1/125 = 0.008
- Unit Code = Wh
- Demand Code = kW (this is automatically set)
- Mode = pulse

If you want to configure for kWh pulsing, you must adjust the pulse weight calculation and unit code as follows:

- Pulse Weight = pulses/kWh = 1/0.125 = 8
- Unit Code = kWh

Input metering setup

Input metering can be configured using the front panel or software.

NOTE: It is recommended you use ION Setup to configure input metering, as setup parameters that require text entry can only be modified using ION Setup.

Configuring input metering using ION Setup

You can use ION Setup to configure the input metering channels.

1. Start ION Setup.

2. Connect to your meter

3. Navigate to **I/O configuration** > **Input metering**.

4. Select an input metering channel to configure and click **Edit**. The **Channel Setup** screen is displayed

5. Enter a descriptive name for the metering channel's **Label**.

6. Configure the other input metering parameters as required.

7. Click **Send** to save your changes.

Input metering setup parameters

Parameter	Values	Description
Label	—	Use this field to change the default label and assign a descriptive name to this input metering channel.
Pulse Weight	0 to 99.99999	Use this field to specify the quantity or value each pulse represents.
Units	No units, Wh, kWh, MWh, VARh, kVARh, MVARh, VAh, kVAh, MVAh, gal, BTU, L, m^3, MCF, lbs, kg, klbs, Therm	Select the unit of measurement associated with the monitored value.
Rate	(see table in "Demand measurements for input metering" on page 76)	For time-based values (such as kWh), this provides the associated demand units (kW) for demand calculations. For other values (such as kg), this can be configured to provide rate information (kg/h).
Mode	Pulse or Transition	Set Mode to Pulse to count only complete pulses. Set Mode to Transition to count each ON-to-OFF or OFF-to-ON status change.
Available Inputs / Assigned Inputs	Digital Input DI1 to DI4	Select the digital input from the Available Inputs box and use the right arrow button to assign the input metering channel to that digital input.

Configuring input metering using the front panel

You can use the front panel to configure the input metering channels.

Input metering setup menu tree
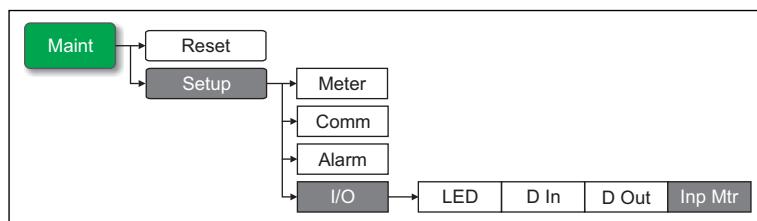
1. Navigate to **Maint > Setup**.

2. Enter the setup password (default is "0"), then press **OK**.

3. Navigate to **I/O > Inp Mtr**.

4. Move the cursor to point to the input metering channel you want to set up, then press **Edit**.

5. Move the cursor to point to the parameter you want to modify, then press **Edit**.

   NOTE: If **Edit** is not displayed, it means the parameter is either read-only or can only be modified through software.

6. Modify the parameter as required, then press **OK**.

7. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.

8. Press ▲ to exit. Press **Yes** to save your changes.

Input metering setup parameters

Parameter	Values	Description
Label	—	This can be modified only through software. Use this field to assign names to the input metering channels (Channel 1 to 4).
Pulse Weight	0 to 99.99999	Use this to specify the quantity or value each pulse represents.
Unit Code	None, Wh, kWh, MWh, VARh, kVARh, MVARh, VAh, kVAh, MVAh, gal, BTU, L, m³, MCF, lbs, kg, klbs, Therm	Select the unit of measurement associated with the monitored value.
Demand Code	(see table in "Demand measurements for input metering" on page 76)	For time-based values (such as kWh), this provides the associated demand units (kW) for demand calculations. For other values (such as kg), this can be configured to provide rate information (kg/h).
Mode	Pulse or Transition	Set Mode to Pulse to count only complete pulses. Set Mode to Transition to count each ON-to-OFF or OFF-to-ON status change.
Digital Inputs	Digital Input DI1 to DI4	Select the digital input port that is used for input metering.

Demand measurements for input metering

Based on the unit code selected, the following demand codes are set or selectable.

Input metering unit and demand measurements

Unit Code	Demand Code	Description
None	None	Default setting for the input metering channels.
Wh		Watt-hour kiloWatt-hour and MegaWatt-hour measurements are converted to calculate demand in kW.
kWh	kW	
MWh		
VARh		VAR-hour kiloVAR-hour and MegaVAR-hour measurements are converted to calculate demand in kVAR.
kVARh	kW	
MVARh		
VAh		VA-hour kiloVA-hour and megaVA-hour measurements are converted to calculate demand in kVA.
kVAh	kW	
MVAh		
gal	GPH, GPM	Select GPH to set rate to gallons per hour, or GPM to set it to gallons per minute.
BTU	BTU/h	BTU (British thermal unit) energy measurements are set to calculate BTUs per hour consumption rate.
L	l/hr, l/min	Select liters per hour or per minute consumption rate.
m³	m³/hr, m³/s, m³/m	Select cubic meters per hour, per second, or per minute consumption rate.
MCF	cfm	Thousand cubic feet volume measurements are converted to calculate cubic feet per minute consumption rate.
lbs		Kilopound (klbs) measurements are converted to calculate pounds per hour consumption rate.
klbs	lb/hr	

Input metering unit and demand measurements (Continued)

Unit Code	Demand Code	Description
kg	kg/hr	Kilogram measurements are set to calculate kilogram per hour consumption rate.
Therm	Thm/h	British therm (equivalent to 100,000 BTU) heat measurements are set to calculate therm per hour consumption rate.

Viewing input metering data

You can use the front panel to view the input metering data.

Using the meter's display

Navigate to the energy screens and select the input metering channel to (Ch1 - Ch4) to view the data.
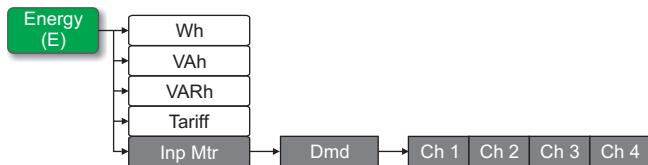
NOTE: The display screen shows accumulation values from 0 to 99999. The display rolls over to zero when accumulated value reaches 100000 and starts incrementing again.

Digital output applications

Digital outputs are typically used in switching applications, for example, to provide on/off control signals for switching capacitor banks, generators, and other external devices and equipment. They can also be used in demand synchronization applications, where the meter provides pulse signals to the input of another meter to control its demand period.

The digital output can also be used in energy pulsing applications, where a receiving device determines energy usage by counting the kWh pulses coming from the meter's digital output port.

⚠ **DANGER**

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA or applicable local standards.
- Turn off all power supplying this device before working on it.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Do not exceed the device's ratings for maximum limits.
- Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions will result in death or serious injury.

NOTE: Be aware that an unexpected change of state of the digital outputs may result when the supply power to the meter is interrupted or after a meter firmware upgrade.

Digital output application example

You can connect one of your meter's digital outputs to a relay that switches on a generator and the other digital output to send a demand sync pulse to other meters. In the following example, the first meter (Meter 1) controls and sets the demand period (900 seconds) of the other meters (Meter 2, Meter 3, Meter 4) through the output pulse occurring at the end of the first meter's demand interval.

Digital output wiring example
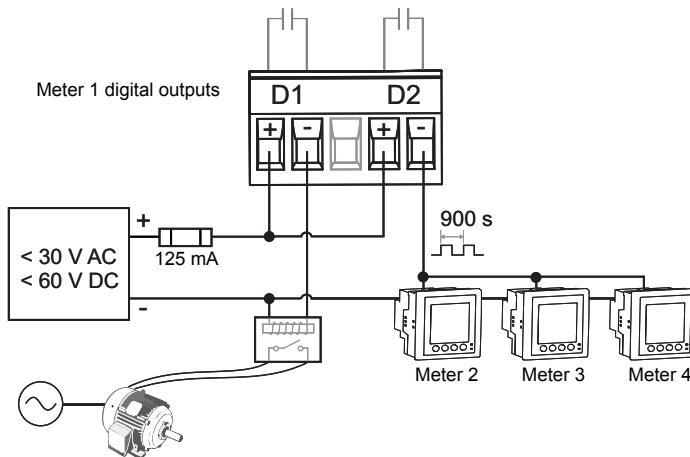
Related topics

- See "Specifications" on page 28 for electrical characteristics and limits for the digital outputs.
- See "Demand setup" on page 40 for details on configuring demand parameters.
- See "Power demand calculation methods" on page 115 for descriptions of the different demand calculation methods.

Digital output setup

The digital output ports (D1 and D2) can be configured using the front panel or ION Setup.

NOTE: It is recommended you use ION Setup to configure the digital outputs, as setup parameters that require text entry can only be modified using software.

Configuring digital outputs using ION Setup

You can use ION Setup to configure the digital outputs (D1 and D2).

1. Start ION Setup.

2. Connect to your meter

3. Navigate to **I/O configuration** > **I/O Setup**.

4. Select a digital output to configure and click **Edit**. The setup screen for that digital output is displayed.

5. Enter a descriptive name for the digital output's **Label**.

6. Configure the other setup parameters as required.

7. Click **Send** to save your changes.

Digital output setup parameters available through ION Setup

Parameter	Values	Description
Label	—	Use this field to change the default label and assign a descriptive name to this digital output.
Control Mode	External, Demand Sync, Alarm	This field displays how the digital output functions. • External: the digital output is controlled remotely either through software or by a PLC using commands sent through communications. • Demand Sync: the digital output is associated with one of the demand systems. The meter sends a pulse to the digital output port at the end of every demand interval. • Alarm: the digital input is associated with the alarm system. The meter sends a pulse to the digital output port when the alarm is triggered.
Behavior Mode	Normal, Timed, Coil Hold	• Normal: this mode applies when control mode is set to External or Alarm. The digital output remains in the ON state until an OFF command is sent by the computer or PLC. • Timed: the digital output remains ON for the period defined by the On Time setup register. • Coil Hold: this mode applies when control mode is set to External or Alarm. For a unary alarm that is associated with a digital output, you must set Behavior Mode to Coil Hold. The output turns on when the "energize" command is received and turns off when the "coil hold release" command is received. In the event of a control power loss, the output remembers and returns to the state it was in when control power was lost.
On Time (s)	0 to 9999	This setting defines the pulse width (ON time) in seconds.
Select Dmd System	Power, Current	Applies when Control Mode is set to Demand Sync. Select the demand system to monitor.
Select Alarms	Over Current, Ph; Under Current, Ph; Over Current, N; Over Current, Gnd; Over Voltage, L-L; Under Voltage, L-L; Over Voltage, L-N; Under Voltage L-N; Over kW; Over kVAR; Over kVA; Lead PF, True; Lag PF, True; Lead PF, Disp; Lag PF, Disp; Over kW Dmd, Pres; Over kW Dmd, Last; Over kW Dmd, Pred; Over kVAR Dmd,Pres; Over kVAR Dmd,Last; Over kVAR Dmd,Pred; Over kVA Dmd, Pres; Over kVA Dmd, Last; Over kVA Dmd, Pred; Over Frequency; Under Frequency; Over Voltage Unbal; Over Voltage THD; Phase Loss	Applies when Control Mode is set to Alarm. Select one or more alarms to monitor.
Associations	—	This field displays additional information if the digital output is already associated with another meter function.

Configuring digital outputs using the front panel

You can use the front panel to configure the digital outputs.

Digital output setup menu tree
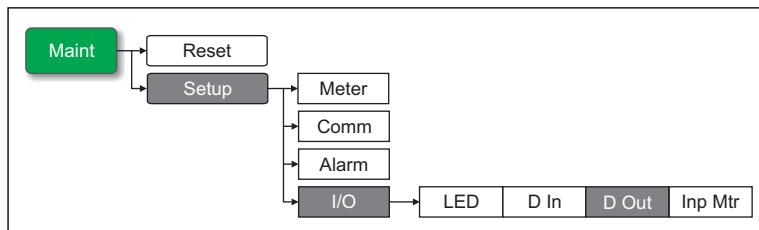
1. Navigate to **Maint > Setup**.

2. Enter the setup password (default is "0"), then press **OK**.

3. Navigate to **I/O > D Out**.

4. Move the cursor to point to the digital output you want to set up, then press **Edit**.

5. Move the cursor to point to the parameter you want to modify, then press **Edit**.

NOTE: If **Edit** is not displayed, it means the parameter is either read-only or can only be modified through software.

6. Modify the parameter as required, then press **OK**.

7. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.

8. Press ▲ to exit. Press **Yes** to save your changes.

Digital output setup parameters available through the front panel

Parameter	Values	Description
Label	-----	This can be modified only through software. Use this field to change the default label and assign a descriptive name to this digital output.
Control Mode	External, Demand Sync, Alarm	This displays how the digital output functions. • External: the digital output is controlled remotely either through software or by a PLC using commands sent through communications. • Demand Sync: the digital output is associated with one of the demand systems. The meter sends a pulse to the digital output port at the end of every demand interval. • Alarm: the digital input is associated with the alarm system. The meter sends a pulse to the digital output port when the alarm is triggered.
Behavior Mode	Normal, Timed, Coil Hold	• Normal: this applies when control mode is set to External or Alarm. The digital output remains in the ON state until an OFF command is sent by the computer or PLC. • Timed: the digital output remains ON for the period defined by the On Time setup register. • Coil Hold: this applies when control mode is set to External or Alarm. For a unary alarm that is associated with a digital output, you must set Behavior Mode to Coil Hold. The output turns on when the "energize" command is received and turns off when the "coil hold release" command is received. In the event of a control power loss, the output remembers and returns to the state it was in when control power was lost.
On Time (s)	0 to 9999	This defines the pulse width (ON time) in seconds.

Digital output setup parameters available through the front panel (Continued)

Parameter	Values	Description
Select Dmd System	Power, Current	Applies when Control Mode is set to Demand Sync. Select the demand system to monitor.
Select Alarms	Over Current, Ph; Under Current, Ph; Over Current, N; Over Current, Gnd; Over Voltage, L-L; Under Voltage, L-L; Over Voltage, L-N; Under Voltage L-N; Over kW; Over kVAR; Over kVA; Lead PF, True; Lag PF, True; Lead PF, Disp; Lag PF, Disp; Over kW Dmd, Pres; Over kW Dmd, Last; Over kW Dmd, Pred; Over kVAR Dmd,Pres; Over kVAR Dmd,Last; Over kVAR Dmd,Pred; Over kVA Dmd, Pres; Over kVA Dmd, Last; Over kVA Dmd, Pred; Over Frequency; Under Frequency; Over Voltage Unbal; Over Voltage THD; Phase Loss	Applies when Control Mode is set to Alarm. Select one or more alarms to monitor.

Related topics

Energy pulsing

You can configure the meter's alarm / energy LED or one of the digital outputs for energy pulsing applications.

Location of alarm / energy pulsing LED

When set to detect alarms, the LED blinks to indicate an alarm condition. See "Alarm priorities" on page 96 for a description of the LED behavior based on different alarms.

When the LED is set to energy pulsing, the meter sends a readable pulse or signal based on the measured energy. This pulse can be used for accuracy verification or as an input to another energy monitoring system. The meter uses the pulse constant setting in pulses per k_h to determine the frequency and number of pulses sent to the LED (where k_h = kWh, kVARh or kVAh depending on the energy parameter selected).

The LED setup screen allows you to configure the alarm / energy pulsing LED for alarming or energy pulsing applications.

Configuring the alarm / energy pulsing LED using the front panel

You can use the front panel display to configure your meter's LED for alarming or energy pulsing application.

Alarm / energy pulsing LED settings menu tree
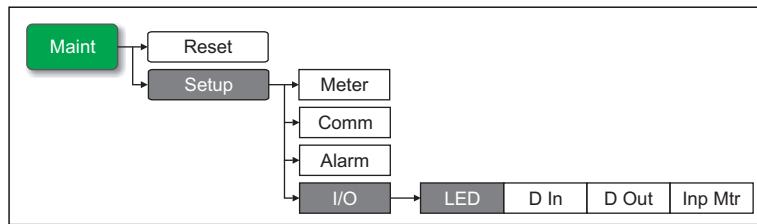
1. Navigate to **Maint > Setup**.

2. Enter the setup password (default is "0"), then press **OK**.

3. Navigate to **I/O > LED**.

4. Move the cursor to point to the parameter you want to modify, then press **Edit**.

   Alarm / energy pulsing LED setup parameters

Setting	Option or range	Description
Mode	Disabled, Alarm, Energy	Disabled turns off the LED completely. Alarm sets the LED for alarm notification. Energy sets the LED for energy pulsing.
Parameter	Active Del, Active Rec, Active Del + Rec, Reactive Del, Reactive Rec, Reactive Del + Rec, Apparent Del, Apparent Rec, Apparent Del + Rec	Select which accumulated energy channel to monitor and use for energy pulsing. This setting is ignored when the LED mode is set to Alarm.
Pulse Wt. (p/k_h)	1 to 9999999	When configured for energy pulsing, this setting defines how many pulses are sent to the LED for every 1 kWh, 1 kVARh or 1kVAh accumulated energy. This setting is ignored when the LED mode is set to Alarm.

5. Press **+** or **−** to modify the parameter as required, then press **OK**.

6. Press ▲ to exit. Press **Yes** to save your changes.

Configuring the LED or digital output for energy pulsing using ION Setup

You can use the ION Setup to configure your meter's LED or digital output for energy pulsing.

1. Start ION Setup.

2. Connect to your meter

3. Navigate to **I/O configuration** > **Energy Pulsing**.

4. Select the LED or a digital output to configure and click **Edit**. The setup screen is displayed.

5. Enter a descriptive name for the digital output's **Label**.

6. Configure the other setup parameters as required.

7. Click **Send** to save your changes.

Alarm / energy pulsing LED setup parameters available through ION Setup

Parameter	Values	Description
Mode	Off, Alarm, Energy	Off disables the LED. Alarm sets the LED for alarm notification. Energy sets the LED for energy pulsing.
Pulse Wt. (p/k_h)	1 to 9999999	When configured for energy pulsing, this defines how many pulses are sent to the LED for every 1 kWh, 1 kVARh or 1kVAh of accumulated energy.
Channel	Active Energy Delivered, Active Energy Received, Active Energy Del+Rec, Reactive Energy Delivered, Reactive Energy Received, Reactive Energy Del+Rec, Apparent Energy Delivered, Apparent Energy Received Apparent Energy Del+Rec	Select which accumulated energy channel to monitor and use for energy pulsing.

Related topics

- See "Alarm display and notification" on page 102 for details on using the front panel to view and acknowledge alarms.
- See "Alarm priorities" on page 96 for a detailed description on the alarm / energy pulsing LED's behavior when it is configured for alarm notification.

Chapter 9   Meter resets

Reset commands clear the meter's onboard data logs and related registers. Meter resets are typically performed after you make changes to the meter's basic setup parameters (such as power system, frequency, or PT/CT settings), to clear invalid or obsolete data in preparation for putting the meter into active service.

The meter reset commands are grouped into two categories: Global Resets and Single Resets.

Related topics

- For meter reset procedures using ION Setup, see "Meter configuration using ION Setup" on page 53.

Front panel meter reset screens

To access the meter reset screens, navigate to **Maint > Reset**.

Reset menu tree
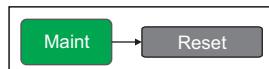
Global resets

Global resets allow you to clear all data of a particular type, such as all energy values or all minimum/maximum values.

Meter Initialization is a special command that clears the meter's recorded logged data, counters and timers. It is common practice to initialize the meter after its configuration is completed, before adding it to an energy management system.

1. Navigate to **Maint > Reset**.

2. Move the cursor to point to **Global Reset**, then press **Select**.

3. Move the cursor to point to the parameter you want to reset, then press **Reset**.

   Global reset options

Parameter	Description
Meter Initialization	Clears all data listed in this table (energy, demand, min/max values, counters, logs, timers, and input metering data).
Energies	Clears all accumulated energy values (kWh, kVARh, kVAh).
Demands	Clears all the demand registers.
Min/Max	Clears all the minimum and maximum registers.
Alarm Counts & Logs	Clears all the alarm counters and alarm logs.
I/O Counts & Timers	Clears all the I/O counters and resets all the timers.
Input Metering	Clears all input metering energy data.

4. Enter the reset password (default is "0"), then press **OK**.

5. Press **Yes** to confirm the reset or **No** to cancel and return to the previous screen.

Single resets

Single resets allow you to clear data only in a specific register or register type.

1. Navigate to **Maint > Reset**.

2. Move the cursor to point to **Single Reset**, then press **Select**.

3. Move the cursor to point to the parameter you want to reset, then press **Reset**. If there are additional options for the parameter, press **Select**, move the cursor to point to the option you want, then press **Reset**.

Single reset options

Parameter	Option		Description
Energy	Accumulated		Clears all accumulated energy values (kWh, kVARh, kVAh).
Demand	Power, Current, Input Metering		Select which demand registers to clear (power demand, current demand or input metering demand).
Alarms	Event Queue		Clears the alarm event queue register (actve alarms list).
	History Log		Clears the alarm history log.
	Counters	All Alarm Counts, (various alarm counters) — see the next table	Select "Counters", then select which counter to clear (choose all or individual alarm counters listed in the "Alarm counter options" table below).
Digital Inputs	Timers	All Dig In Timers, Digital Input DI1, Digital Input DI2, Digital Input DI3, Digital Input DI4	Select "Timers", then select which digital input timer to clear (choose all or individual digital input timers).
	Counters	All Dig In Counters, Digital Input DI1, Digital Input DI2, Digital Input DI3, Digital Input DI4	Select "Timers", then select which digital input counter to clear (choose all or individual digital input counters).
Digital Outputs	Timers	All Dig Out Timers, Digital Output DO1, Digital Output DO2	Select "Timers", then select which digital output timer to clear (choose all or individual digital output timers).
	Counters	All Dig Out Counters, Digital Output DO1, Digital Output DO2	Select "Timers", then select which digital output counter to clear (choose all or individual digital output counters).
Active Load Timer			Clears and restarts the load operation timer.
Multi-Tariff			Clears accumulated values in all tariff register.
Input Metering	Reset All InptMtr, Reset InpMtr Chan 1, Reset InpMtr Chan 2, Reset InpMtr Chan 3,Reset InpMtr Chan 4		Select which input metering channel (InpMtr Chan) to clear (choose all or individual input metering channels).

4. Enter the reset password (default is "0"), then press **OK**.

5. Press **Yes** to confirm the reset or **No** to cancel and return to the previous screen.

Alarm counter options

Alarm counter	Option	Description
Current	Over Current, Ph	Select which alarm counter register to reset from the current alarm condition counters.
	Under Current, Ph	
	Over Current, N	
	Over Current, Gnd	
Voltage	Over Voltage, L-L	Select which alarm counter register to reset from the voltage alarm condition counters.
	Under Voltage, L-L	
	Over Voltage, L-N	
	Under Voltage, L-N	
	Over Voltage Unbal	
	Over Voltage THD	
	Phase Loss	

Alarm counter options (Continued)

Alarm counter	Option	Description
Power	Over kW	Select which alarm counter register to reset from the power alarm condition counters.
	Over kVAR	
	Over kVA	
Power Factor	Lead PF, True	Select which alarm counter register to reset from the power factor alarm condition counters.
	Lag PF, True	
	Lead PF, Disp	
	Lag PF, Disp	
Demand	Over kW Dmd, Pres	Select which alarm counter register to reset from the demand alarm condition counters.
	Over kW Dmd, Last	
	Over kW Dmd, Pred	
	Over kVAR Dmd, Pres	
	Over kVAR Dmd, Last	
	Over kVAR Dmd, Pred	
	Over kVA Dmd, Pres	
	Over kVA Dmd, Last	
	Over kW Dmd, Pred	
Frequency	Over Frequency	Select which alarm counter register to reset from the frequency alarm condition counters.
	Under Frequency	
Unary	Meter Powerup	Select which alarm counter register to reset from the unary alarm condition counters.
	Meter Reset	
	Meter Diagnostic	
	Phase Reversal	
Digital Inputs	Digital Alarm DI1	Select which alarm counter register to reset from the digital input alarm condition counters.
	Digital Alarm DI2	
	Digital Alarm DI3	
	Digital Alarm DI4	
Cust1s	Custom Alarm 1	Select which alarm counter register to reset from the custom 1-second alarm condition counters.
	Custom Alarm 2	
	Custom Alarm 3	
	Custom Alarm 4	
	Custom Alarm 5	
Logic	Logic Alarm 1	Select which alarm counter register to reset from the logic alarm condition counters.
	Logic Alarm 2	
	Logic Alarm 3	
	Logic Alarm 4	
	Logic Alarm 5	
	Logic Alarm 6	
	Logic Alarm 7	
	Logic Alarm 8	
	Logic Alarm 9	
	Logic Alarm 10	

Chapter 10   Alarms

This section describes the meter's alarms feature. An alarm is the meter's means of notifying you when an alarm condition is detected, such as an error or an event that falls outside of normal operating conditions.

⚠ **WARNING**
UNINTENDED OPERATION
Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.
Failure to follow this instruction can result in death or serious injury.

Alarm overview

When an alarm is tripped, the meter records the alarm event, and the alarm indicator appears on the meter display if it is a low, medium or high priority alarm. The alarm can also be used to trigger another event, such as controlling a digital output.

NOTE: If configured for alarms, the alarm / energy pulsing LED flashes when the alarm is tripped. See "LED alarm indicator" on page 101 to set up the LED for alarms.

Alarm types

The meter supports these types of alarms (total available indicated in parentheses):

- Unary (4)
- Digital (4)
- Standard (29)
- Logic (10)
- Custom (5)

Unary alarms

A unary alarm is the simplest type of alarm — it monitors a single behavior, event or condition.

Unary alarms

Alarm label	Description
Meter Power Up	Meter powers on after losing control power.
Meter Reset	Meter resets for any reason.
Meter Diagnostic	Meter's self-diagnostic feature detects a problem.
Phase Reversal	Meter detects a phase rotation different than expected.

Digital alarms

Digital alarms monitor the ON or OFF state of the meter's digital inputs (S1 to S4).

Digital alarms

Alarm label	Description
Digital Alarm S1	Digital input 1
Digital Alarm S2	Digital input 2
Digital Alarm S3	Digital input 3
Digital Alarm S4	Digital input 4

Digital alarm with setpoint delay

To prevent false triggers from erratic signals, you can set up a time delay for the digital alarm.

Adding setpoint delays to a digital alarm
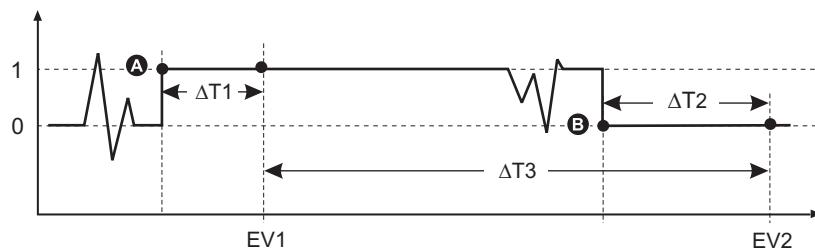
A	Pickup setpoint (1 = ON)
B	Dropout setpoint (0 = OFF)
ΔT1	Pickup time delay (in seconds)
EV1	Start of alarm condition

ΔT2	Dropout time delay (in seconds)
EV2	End of alarm condition
ΔT3	Alarm duration (in seconds)

NOTE: To prevent filling the alarm log with nuisance alarm trips, the digital alarm is automatically disabled if the digital input changes state more than 4 times in one second or more than 10 times in ten seconds. See "Digital input setup" on page 72 to adjust the Debounce setting for the digital inputs.

Standard alarms

Standard (1-Sec) alarms have a detection rate equal to the 50/60 meter cycle, which is nominally 1 second if the meter's frequency setting is configured to match the system frequency (50 or 60 Hz). These setpoint-driven alarms monitor certain behaviors, events or unwanted conditions in your electrical system.

Many of the standard alarms are three-phase alarms. Alarm setpoints are evaluated for each of the three phases individually, but the alarm is reported as a single alarm. The alarm pickup occurs when the first phase exceeds the alarm pickup magnitude for the pickup time delay. The alarm is active as long as any phase remains in an alarm state. The alarm dropout occurs when the last phase drops below the dropout magnitude for the dropout time delay.

Standard (1-Sec) alarms

Alarm label		Valid range and resolution[1]		Units
ION Setup	Meter display	ION Setup	Meter display	
Over Phase Current	Over Current, Ph	0.000 to 99999.000	0 to 99999	A
Under Phase Current	Under Current, Ph	0.000 to 99999.000	0 to 99999	A
Over Neutral Current	Over Current, N	0.000 to 99999.000	0 to 99999	A

Standard (1-Sec) alarms (Continued)

Alarm label		Valid range and resolution[1]		Units
ION Setup	Meter display	ION Setup	Meter display	
Over Ground Current	Over Current, Gnd	0.000 to 99999.000	0 to 99999	A
Over Voltage L-L	Over Voltage, L-L	0.00 to 999999.00	0 to 999999	V
Under Voltage L-L	Under Voltage, L-L	0.00 to 999999.00	0 to 9999999	V
Over Voltage L-N	Over Voltage, L-N	0.00 to 999999.00	0 to 9999999	V
Under Voltage L-N	Under Voltage L-N	0.00 to 999999.00	0 to 9999999	V
Over Active Power	Over kW	0.0 to 9999999.0	0 to 9999999	kW
Over Reactive Power	Over kVAR	0.0 to 9999999.0	0 to 9999999	kVAR
Over Apparent Power	Over kVA	0.0 to 9999999.0	0 to 9999999	kVA
Leading True PF	Lead PF, True	-1.00 to -0.01 and 0.01 to 1.00		—
Lagging True PF	Lag PF, True	-1.00 to -0.01 and 0.01 to 1.00		—
Leading Disp PF	Lead PF, Disp	-1.00 to -0.01 and 0.01 to 1.00		—
Lagging Disp PF	Lag PF, Disp	-1.00 to -0.01 and 0.01 to 1.00		—
Over Present Active Power Demand	Over kW Dmd, Pres	0.0 to 9999999.0	0 to 9999999	kW
Over Last Active Power Demand	Over kW Dmd, Last	0.0 to 9999999.0	0 to 9999999	kW
Over Predicted Active Power Demand	Over kW Dmd, Pred	0.0 to 9999999.0	0 to 9999999	kW
Over Present Reactive Power Demand	Over kVAR Dmd,Pres	0.0 to 9999999.0	0 to 9999999	kVAR
Over Last Reactive Power Demand	Over kVAR Dmd,Last	0.0 to 9999999.0	0 to 9999999	kVAR
Over Predicted Reactive Power Demand	Over kVAR Dmd,Pred	0.0 to 9999999.0	0 to 9999999	kVAR
Over Present Apparent Power Demand	Over kVA Dmd, Pres	0.0 to 9999999.0	0 to 9999999	kVA
Over Last Apparent Power Demand	Over kVA Dmd, Last	0.0 to 9999999.0	0 to 9999999	kVA
Over Predicted Apparent Power Demand	Over kVA Dmd, Pred	0.0 to 9999999.0	0 to 9999999	kVA
Over Frequency	Over Frequency	0.000 to 99.000		Hz
Under Frequency	Under Frequency	0.000 to 99.000		Hz
Over Voltage Unbalance	Over Voltage Unbal	0.000 to 999999.000	0 to 9999999	V
Over Voltage THD	Over Voltage THD	0.000 to 99		%
Phase Loss	Phase Loss	0.00 too 999999.00	0 to 999999	—

[1] Some alarms use the system type and the VT or CT ratio to determine the maximum allowed setpoint. See "Maximum allowable setpoint" on page 93.

NOTE: Some alarms do not apply to all power system configurations. For example, line-to-neutral voltage alarms cannot be enabled on 3-phase delta systems.

Setpoint conditions

A setpoint condition occurs when the magnitude of the signal being monitored crosses the limit specified by the pickup setpoint setting and stays within that limit for a minimum time period specified by the pickup time delay setting.

The setpoint condition ends when the magnitude of the signal being monitored crosses the limit specified by dropout setpoint setting and stays within that limit for a minimum time period specified by dropout time delay setting.

The meter supports these types of setpoint conditions:

Over setpoint

When the value rises above the pickup setpoint setting and remains there long enough to satisfy the pickup time delay period (ΔT1), the alarm condition is set to ON. When the value falls below the dropout setpoint setting and remains there long enough to satisfy the dropout time delay period (ΔT2), the alarm condition is set to OFF.

A	Pickup setpoint		ΔT2	Dropout time delay (in seconds)
B	Dropout setpoint		EV2	End of alarm condition
ΔT1	Pickup time delay period (in seconds)		ΔT3	Alarm duration (in seconds)
EV1	Start of alarm condition		Max1	Maximum value recorded during pickup period
			Max2	Maximum value recorded during alarm period

The meter records the date and time when the alarm event starts (EV1) and when it ends (EV2). The meter also performs any task assigned to the event, such as operating a digital output. The meter also records maximum values (Max1, Max2) before, during or after the alarm period.

Under setpoint

When the value falls below the pickup setpoint setting and remains there long enough to satisfy the pickup time delay period (ΔT1), the alarm condition is set to ON. When the value rises above the dropout setpoint setting and remains there long enough to satisfy the dropout time delay period (ΔT2), the alarm condition is set to OFF.

A	Pickup setpoint		ΔT2	Dropout time delay (in seconds)
B	Dropout setpoint		EV2	End of alarm condition
ΔT1	Pickup delay period (in seconds)		ΔT3	Alarm duration (in seconds)
EV1	Start of alarm condition		Min1	Minimum value recorded during pickup period
			Min2	Minimum value recorded during alarm period

The meter records the date and time when the alarm event starts (EV1) and when it ends (EV2). The meter also performs any task assigned to the event, such as operating a digital output. The meter also records minimum values (Min1, Min2) before, during or after the alarm period.

Maximum allowable setpoint

The meter is programmed to help prevent user data entry errors. Limits have been set for the standard (1-Sec) alarms.

The maximum setpoint value you can enter for some of the standard alarms depend on the voltage transformer ratio (VT ratio), current transformer ratio (CT ratio), system type (i.e., number of phases) and/or the maximum voltage and maximum current limits programmed at the factory.

NOTE: VT ratio is the VT primary divided by the VT secondary, and CT ratio is the CT primary divided by the CT secondary.

Standard alarm maximum setpoint values

Standard alarm	Maximum setpoint value
Over Phase Current	(maximum current) x (CT ratio)
Under Phase Current	(maximum current) x (CT ratio)
Over Neutral Current	(maximum current) x (CT ratio) x (number of phases)
Over Ground Current	(maximum current) x (CT ratio)
Over Voltage L-L	(maximum voltage) x (VT ratio)
Under Voltage L-L	(maximum voltage) x (VT ratio)
Over Voltage L-N	(maximum voltage) x (VT ratio)
Under Voltage L-N	(maximum voltage) x (VT ratio)
Over Active Power	(maximum voltage) x (maximum current) x (number of phases)
Over Reactive Power	(maximum voltage) x (maximum current) x (number of phases)
Over Apparent Power	(maximum voltage) x (maximum current) x (number of phases)
Over Present Active Power Demand	(maximum voltage) x (maximum current) x (number of phases)
Over Last Active Power Demand	(maximum voltage) x (maximum current) x (number of phases)
Over Predicted Active Power Demand	(maximum voltage) x (maximum current) x (number of phases)
Over Present Reactive Power Demand	(maximum voltage) x (maximum current) x (number of phases)
Over Last Reactive Power Demand	(maximum voltage) x (maximum current) x (number of phases)
Over Predicted Reactive Power Demand	(maximum voltage) x (maximum current) x (number of phases)
Over Present Apparent Power Demand	(maximum voltage) x (maximum current) x (number of phases)
Over Last Apparent Power Demand	(maximum voltage) x (maximum current) x (number of phases)
Over Predicted Apparent Power Demand	(maximum voltage) x (maximum current) x (number of phases)
Over Voltage Unbalance	(maximum voltage) x (VT ratio)
Phase Loss	(maximum voltage) x (VT ratio)

Power factor (PF)

You can set up a Leading PF or Lagging PF alarm to monitor when the circuit's power factor goes above or below the threshold you specify. The Leading PF and Lagging PF alarms use the power factor quadrants as the values on the y-axis, with quadrant II on the lowest end of the scale, followed by quadrant III, quadrant I, and finally quadrant IV on the highest end of the scale.

PF quadrants and related values

Quadrant	PF values	Lead/Lag
II	0 to -1	Leading (capacitive)
III	-1 to 0	Lagging (inductive)
I	0 to 1	Lagging (inductive)
IV	1 to 0	Leading (capacitive)

Leading PF

The Leading PF alarm monitors an over setpoint condition.
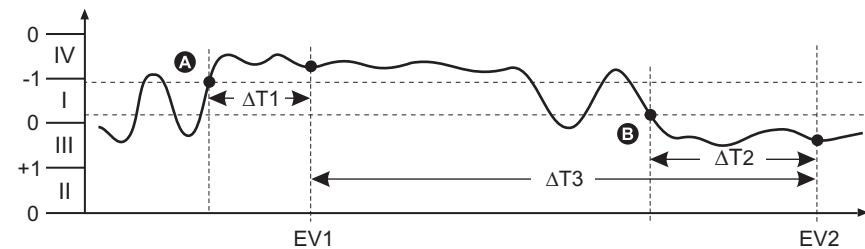
A	Pickup setpoint	ΔT2	Dropout time delay (in seconds)
B	Dropout setpoint	EV2	End of alarm condition
ΔT1	Pickup delay period (in seconds)	ΔT3	Alarm duration (in seconds)
EV1	Start of alarm condition		

Lagging PF

The Lagging PF alarm monitors an under setpoint condition.
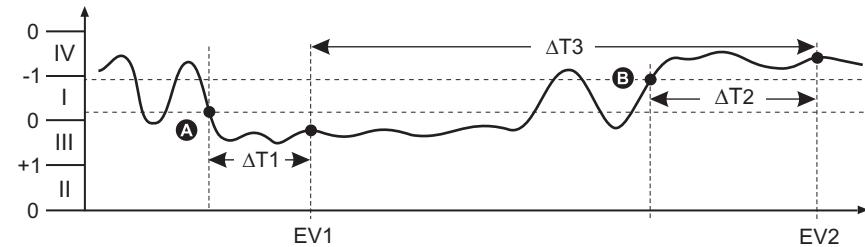
A	Pickup setpoint	ΔT2	Dropout time delay (in seconds)
B	Dropout setpoint	EV2	End of alarm condition
ΔT1	Pickup delay period (in seconds)	ΔT3	Alarm duration (in seconds)
EV1	Start of alarm condition		

Phase loss

The phase loss alarm is an under setpoint alarm. It monitors the voltages on a 3-phase system and triggers the alarm when one or two phases fall below the pickup setpoint setting and remains there long enough to satisfy the pickup time delay period. When all of the phases rises above the dropout setpoint setting and remains there long enough to satisfy the dropout time delay period, the alarm condition is set to OFF.

Logic alarms

The meter supports up to 10 logic alarms (Logic Alarm 1 to 10). A logic alarm is used to monitor up to four different inputs or parameters. The logic alarm is tripped when the individual states of all the inputs (A, B, C, D) cause the output (Y) of a logic operation to be true.
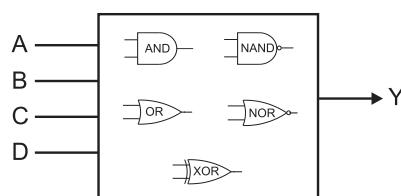
The logic alarm inputs can only be linked using software.

Custom alarms

Custom alarms (Cust1s) are setpoint-driven alarms, similar to the standard (1-Sec) alarms.

A custom alarm's input parameters and setpoint subtypes can only be configured using software. The pickup setpoint and dropout setpoint limits are set to -999999 to 999999.

Custom alarms parameter list

Alarm parameter	Unit		Alarm parameter	Unit
Current A	A		Active Energy Delivered	kW
Current B	A		Active Energy Received	kW
Current C	A		Active Energy Delivered + Received	kW
Current N	A		Active Energy Delivered - Received	kW
Current G	A		Reactive Energy Delivered	kVAR
Current Avg	A		Reactive Energy Received	kVAR
Current Unbalance A	%		Reactive Energy Delivered + Received	kVAR
Current Unbalance B	%		Reactive Energy Delivered - Received	kVAR
Current Unbalance C	%		Apparent Energy Delivered	kVA
Current Unbalance Worst	%		Apparent Energy Received	kVA
Voltage A-B	V		Apparent Energy Delivered + Received	kVA
Voltage B-C	V		Apparent Energy Delivered - Received	kVA
Voltage C-A	V		Input Metering CH 01 Accumulation	—
Voltage L-L Avg	V		Input Metering CH02 Accumulation	—
Voltage A-N	V		Input Metering CH03 Accumulation	—
Voltage B-N	V		Input Metering CH04 Accumulation	—
Voltage C-N	V		Active Power Last Demand	kW
Voltage L-N Avg	V		Active Power Present Demand	kW
Voltage Unbalance A-B	%		Active Power Predicted Demand	kW
Voltage Unbalance B-C	%		Reactive Power Last Demand	kVAR
Voltage Unbalance C-A	%		Reactive Power Present Demand	kVAR
Voltage Unbalance L-L \Worst	%		Reactive Power Predicted Demand	kVAR
Voltage Unbalance A-N	%		Apparent Power Last Demand	kVA
Voltage Unbalance B-N	%		Apparent Power Present Demand	kVA
Voltage Unbalance C-N	%		Apparent Power Predicted Demand	kVA
Voltage Unbalance L-N Worst	%		Current A Last Demand	A
Active Power A	kW		Current A Present Demand	A
Active Power B	kW		Current A Predicted Demand	A
Active Power C	kW		THD Current A	%
Active Power Total	kW		THD Current B	%
Reactive Power A	kVAR		THD Current C	%
Reactive Power B	kVAR		THD Current N	%
Reactive Power C	kVAR		THD Current G	%
Reactive Power Total	kVAR		thd Current A	%
Apparent Power A	kVA		thd Current B	%
Apparent Power B	kVA		thd Current C	%
Apparent Power C	kVA		thd Current N	%
Apparent Power Total	kVA		thd Current G	%
Frequency	Hz		Min Freq	Hz
Temperature	°C		Max Active Power A	kW
			Max Total Demand Distortion	%
			Max Freq	%

Alarms setup overview

You can use the meter display or ION Setup to configure unary, digital or standard (1-Sec) alarms. To configure logic and custom alarms, you must use ION Setup.

NOTE: If you make changes to the basic power meter setup, all alarms are disabled to prevent undesired alarm operation.

NOTICE

UNINTENDED EQUIPMENT OPERATION

After modifying any basic setup parameter:

- Verify all standard alarms settings are correct and make adjustments as necessary.
- Re-enable all configured alarms.

Failure to follow these instructions can result in incorrect alarm functions.

Built-in error-checking

ION Setup dynamically checks incorrect setup combinations. When you enable an alarm, you must set up the pickup and dropout limits to acceptable values first in order to exit the setup screen.

Alarm priorities

Each alarm has a priority level. Use priorities to distinguish between events that require immediate action and those that do not require action.

Alarm notification through the meter display

Alarm priority	Alarm notification and recording method			
	Alarm LED[1]	Alarm icon	Alarm details	Alarm logging
High	Blinks while the alarm is active.	Blinks while the alarm is active. Alarm icon remains displayed until acknowledged.	Click **Details** to display what caused the alarm to pickup or drop off. Click **Ack** to acknowledge the alarm.	Recorded in alarm log.
Medium	Blinks while the alarm is active.	Blinks while the alarm is active.	Click **Details** to display what caused the alarm to pickup or drop off.	Recorded in alarm log.
Low	Blinks while the alarm is active.	Blinks while the alarm is active.	Click **Details** to display what caused the alarm to pickup or drop off..	Recorded in alarm log.
None	No activity	None	None	Recorded in event log only.

[1] If the alarm / energy pulsing LED is configured for alarming.

Active alarms

When a pickup event occurs, the active alarm list appears on the meter display's Active Alarms screen. Press "Detail" to see more event information. See "Active alarms" on page 102 for more information.

Multiple alarm considerations

If multiple alarms with different priorities are active at the same time, the display shows the alarms in the order they occurred.

Related topics

- See "Monitoring" on page 58 to view the active alarms list using a web browser.

Alarm setup using the meter display

If your meter is equipped with a display:

1. Navigate to the alarms setup menu screens and select the alarm you want to set up. See "Front panel display and meter setup" on page 33 for basic instructions on using the front panel buttons to navigate the meter screens.
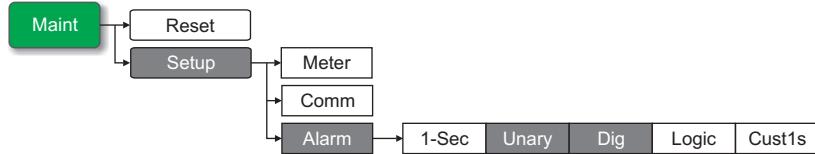
2. Configure the setup parameters as explained in the different alarm setup sections.

3. When prompted, click **Yes** to save the changes to the meter.

NOTE: You must use ION Setup to create logic and custom (Cust1s) alarms. After the alarm is created, you can use ION Setup or the meter display to modify the alarm parameters.

NOTE: If you used ION Setup to program decimal values on a standard (1-Sec) alarm, do not use the meter display to make subsequent changes to any alarm parameters (including enable/disable), as doing so will cause removal of all decimals previously programmed through ION Setup.

Alarm setup using ION Setup

To set up all alarm types using ION Setup, open the **Alarming** setup screen to view the different alarm types. See the ION Setup online help for details.

Setting up unary alarms

Select the unary alarm you want to configure then use the following controls to set up the alarm (ION Setup controls are shown in parentheses).

Unary alarm setup parameters

Setting	Option or range	Description
Enable	Yes (checked) or No (cleared)	This enables or disables the alarm.
Priority	High, Medium, Low, None	This sets the alarm priority and notification options. See "Alarm priorities" on page 96.
Select Dig Output (Outputs)	None, Digital Output D1, Digital Output D2, Digital Output D1 & D2	Select the digital output(s) you want to control when the alarm is triggered.

Setting up digital alarms

Select the digital alarm you want to configure then use the following controls to set up the alarm (ION Setup controls are shown in parentheses).

Digital alarm setup parameters

Setting	Option or range	Description
Enable	Yes (checked) or No (cleared)	This enables or disables the alarm.
Priority	High, Medium, Low, None	This sets the alarm priority and notification options. See "Alarm priorities" on page 96.

Digital alarm setup parameters (Continued)

Setting	Option or range	Description
Pickup Setpoint (Setpoint Pickup)	On, Off	Use this setting to control when to trip the alarm, based on the state of the digital input (On or Off).
Pickup Time Delay (Delay)	0 to 999999	This specifies the number of seconds the digital input must be in the alarm pickup state before the alarm is tripped.
Dropout Time Delay (Setpoint Dropout Delay)	0 to 999999	This specifies the number of seconds the digital input must be out of the alarm pickup state before the alarm turns off.
Select Dig Output (Outputs)	None, Digital Output D1, Digital Output D2, Digital Output D1 & D2	Select the digital output(s) you want to control when the alarm is triggered.

Setting up standard (1-sec) alarms

Select the standard (1-Sec) alarm you want to configure then use the following controls to set up the alarm (ION Setup controls are shown in parentheses).

NOTE: It is recommended that you use ION Setup to configure standard (1-Sec) alarms. ION Setup supports a higher resolution to allow you to specify more decimal places when setting up the pickup setpoint and dropout setpoint values for certain measurements.

NOTICE

UNINTENDED EQUIPMENT OPERATION

After configuring alarms in ION Setup:

• Do not use the meter display to make any changes to the alarms, otherwise all decimals previously programmed in ION Setup will be lost.

Failure to follow these instructions can result in incorrect alarm functions.

Standard (1-sec) alarm setup parameters

Setting	Option or range	Description
Enable	Yes (checked) or No (cleared)	This enables or disables the alarm.
Priority	High, Medium, Low, None	This sets the alarm priority and notification options. See "Alarm priorities" on page 96.
Pickup Setpoint (Pickup Limit)	See "Standard (1-Sec) alarms" on page 90	This is the value (magnitude) you define as the setpoint limit for triggering the alarm. For "over" conditions, this means the value has gone above the Pickup limit. For "under" conditions, this means the value has gone below the Pickup limit.
Pickup Time Delay (Delay)	0 to 999999	This specifies the number of seconds the signal must stay above the pickup setpoint (for "over" conditions), or below the pickup setpoint (for "under" conditions) before the alarm is tripped.
Dropout Setpoint (Dropout Limit)	See "Standard (1-Sec) alarms" on page 90	This is the value (magnitude) you define as the limit for dropping out of the alarm condition. For "over" conditions, this means the value has gone below the Dropout limit. For "under" conditions, this means the value has gone above the Pickup limit.
Dropout Time Delay (Delay)	0 to 999999	This specifies the number of seconds the signal must stay below the dropout setpoint (for "over" conditions), or above the dropout setpoint (for "under" conditions) before the alarm condition is ended.
PU Set Point Lead/Lag (Lead, Lag)	Lead or Lag	Applies to PF (power factor) alarms only. Use this set the PF value and quadrant to set the pickup setpoint for an over PF condition (PF Leading) or under PF condition (PF Lagging). See "Power factor (PF)" on page 93

Standard (1-sec) alarm setup parameters (Continued)

Setting	Option or range	Description
DO Set Point Lead/Lag (Lead, Lag)	Lead or Lag	Applies to PF (power factor) alarms only. Use this set the PF value and quadrant to set the dropout setpoint for an over PF condition (PF Leading) or under PF condition (PF Lagging). See "Power factor (PF)" on page 93
Select Dig Output (Outputs)	None, Digital Output D1, Digital Output D2, Digital Output D1 & D2	Select the digital output(s) you want to control when the alarm is triggered.

Setting up logic alarms

Use ION Setup to configure logic alarms.

NOTE: You must first configure the alarms you want to use as inputs to a logic alarm. For example, if you use a standard (1-Sec) alarm as one of the inputs, you must set up its setpoint pickup, dropout and delay parameters.

1. Select the logic alarm you want to set up, then click **Edit**.

2. Select the alarms you want to use as inputs to the logic alarm.

3. Click the double-arrow button to move the selected alarm to the **Selected (max 4)** box, then click **OK**.

4. Repeat to add more inputs to the logic alarm.

5. Configure the rest of the alarm setup parameters, click **OK**, then **Send** to save your changes to the meter.

Logic alarm setup parameters

Setting	Option or range	Description
Edit	—	See the preceding procedure. This button allows you to select up to 4 input parameters that you want to compare against each other. The logic alarm is set when the result of the specified logic operation on all inputs is true.
Enable	Yes (checked) or No (cleared)	This enables or disables the alarm.
Label	Logic Alarm 1 to Logic Alarm 10 (default labels)	ION Setup lets you modify the default label so it more clearly identifies your logic alarm. You can only use letters, numbers and underscores. Spaces are not allowed.
Type	AND	Output of AND operation is True only if all inputs are True.
	NAND	Output of NAND operation is True if one or more inputs are False.
	OR	Output of OR operation is True if one or more inputs are True.
	NOR	Output of NOR operation is True only if all inputs are False.
	XOR	Output of XOR operation is True if only one input is True, and all other inputs are False.
Priority	High, Medium, Low, None	This sets the alarm priority and notification options. See "Alarm priorities" on page 96.
Select Dig Output (Outputs)	None, Digital Output D1, Digital Output D2, Digital Output D1 & D2	Select the digital output(s) you want to control when the alarm is triggered.

Logic alarm setup error prompts

Both the meter and ION Setup have error-checking provisions, and alert you with an error message if the following actions are attempted:

- The output of a logic alarm is used as an input to itself.
- The same source is duplicated as another input on the same logic alarm.
- The source register used is invalid or is a nonexistent parameter.

Setting up custom alarms

Use ION Setup to configure custom (Cust1s) alarms.

1. Select the custom alarm you want to set up, then click **Enable** to display the available setup options.

2. Use the dropdown list to select the parameter you want to set for your custom alarm.

3. Use the **Label** box to define a name for your custom alarm.

4. Use the dropdown list to select the setpoint condition you want to monitor:

   — Over: Alarm condition occurs when the value goes above the pickup setpoint setting.

   — Under: Alarm condition occurs when the value goes below the pickup setpoint setting.

   — Over (absolute): Alarm condition occurs when the absolute value goes above the pickup setpoint setting.

   — Under (absolute): Alarm condition occurs when the absolute value goes below the pickup setpoint setting.

5. Configure the rest of the alarm setup parameters, click **OK**, then **Send** to save your changes to the meter.

Custom alarm setup parameters

Setting	Option or range	Description
Enable	Yes (checked) or No (cleared)	This enables or disables the alarm.
Setpoint Pickup	See "Standard (1-Sec) alarms" on page 90	This is the value (magnitude) you define as the setpoint limit for triggering the alarm. For "over" conditions, this means the value has gone above the Pickup limit. For "under" conditions, this means the value has gone below the Pickup limit.
Delay (Setpoint Pickup)	0 to 999999	This specifies the number of seconds the signal must stay above the pickup setpoint (for "over" conditions), or below the pickup setpoint (for "under" conditions) before the alarm is tripped.
Setpoint Dropout	See "Standard (1-Sec) alarms" on page 90	This is the value (magnitude) you define as the limit for dropping out of the alarm condition. For "over" conditions, this means the value has gone below the Dropout limit. For "under" conditions, this means the value has gone above the Pickup limit.
Delay (Setpoint Dropout)	0 to 999999	This specifies the number of seconds the signal must stay below the dropout setpoint (for "over" conditions), or above the dropout setpoint (for "under" conditions) before the alarm condition is ended.
Priority	High, Medium, Low, None	This sets the alarm priority and notification options. See "Alarm priorities" on page 96.
Select Dig Output (Outputs)	None, Digital Output D1, Digital Output D2, Digital Output D1 & D2	Select the digital output(s) you want to control when the alarm is triggered.

LED alarm indicator

You can use the meter's alarm / energy pulsing LED as an alarm indicator.

Location of alarm / energy pulsing LED
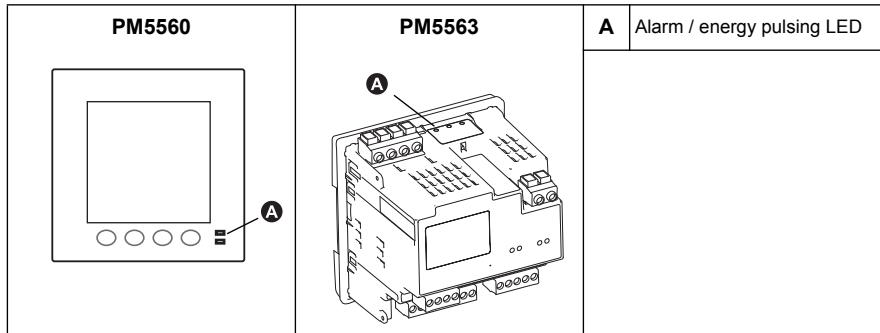
PM5560	PM5563	A	Alarm / energy pulsing LED

When set to detect alarms, the LED blinks to indicate an alarm condition. See "Alarm priorities" on page 96 for a description of the LED behavior based on different alarms.

Configuring the LED for alarms using the meter display

You can use the meter display to configure the alarm /energy pulsing LED for alarming.
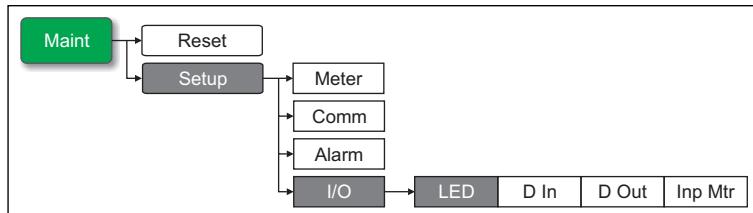
1. Navigate to the LED setup menu screen.
   Alarm / energy pulsing LED setup parameters

Setting	Option or range	Description
Mode	Disabled, Alarm, Energy	Disabled turns off the LED completely. Alarm sets the LED for alarm notification. Energy sets the LED for energy pulsing.
Parameter	Active Del, Active Rec, Active Del + Rec, Reactive Del, Reactive Del + Rec, Apparent Del, Apparent Rec, Apparent Del + Rec	Select which accumulated energy channel to monitor and use for energy pulsing. This setting is ignored when the LED mode is set to Alarm.
Pulse Wt. (p/k_h)	1 to 9999999	When configured for energy pulsing, this setting defines how many pulses are sent to the LED for every 1 kWh, 1 kVARh or 1kVAh accumulated energy. This setting is ignored when the LED mode is set to Alarm.

2. Set the mode to **Alarm**, then press **OK**.

3. Press ▲ to exit. Press **Yes** to save your changes.

Configuring the LED for alarms using ION Setup

You can use the ION Setup to configure your meter's LED for alarming.

1. Start ION Setup.

2. Connect to your meter

3. Navigate to **I/O configuration** > **Energy Pulsing**.

4. Select **Front Panel LED** and click **Edit**.

5. Set the control mode to **Alarm**.

6. Click **Send** to save your changes.

Using alarms for external control

You can set the alarm to trigger a digital output, which you can then use to control an external relay. See "Digital output applications" on page 77 for details.

Alarm screens

If your meter is equipped with a display, use the front panel buttons to navigate to the alarm setup or display screens.
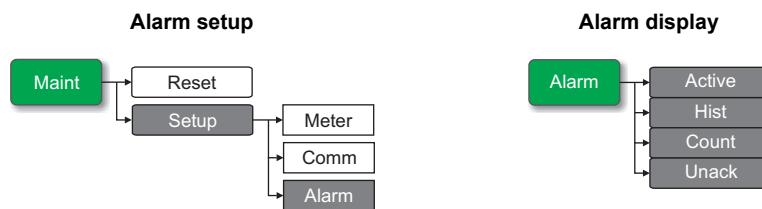
Alarm display and notification

The meter notifies you when an alarm condition is detected. "Alarm priorities" on page 96 outlines the differences in alarm notification based on alarm priorities.

Alarm icon

When a low, medium or high priority alarm is tripped, this symbol appears at the top right corner of the display screen, indicating that an alarm is active:

For high priority alarms, the alarm icon remains displayed until you acknowledge the alarm.

Alarm / energy LED

If configured for alarming, the alarm / energy pulsing LED also flashes to indicate the meter has detected an alarm condition. See "LED alarm indicator" on page 101.

Alarm details

Details about the alarms can be viewed from the active alarms (Active), alarm history (Hist), alarm counters (Count) and unacknowledged alarms (Unack) screens.

Active alarms

When an alarm condition becomes true (alarm = ON), the alarm is displayed on the active alarms screen. The alarm details (for low, medium and high priority alarms) are also recorded in the alarm history log.

Viewing active alarm details

1. Navigate to **Alarm > Active**.

2. Select the alarm you want to view (the latest ones appear on top). Press **Detail**.

   NOTE: For unacknowledged high priority alarms, the **Ack** option appears on this screen. Press **Ack** to acknowledge the alarm, or return to the previous screen if you do not want to acknowledge the alarm.

The alarm details show the date and time of the alarm event, the type of event (e.g., pickup or unary), which phase the alarm condition was detected on, and the value that caused the alarm condition.

NOTE: Alarm details are not available if the alarm priority is set to None.

Alarm history

The alarm history log keeps a record of active alarms and past alarms. When an active alarm condition becomes false (alarm = OFF), the event is recorded in the alarm history log and alarm notification (alarm icon, alarm LED) is turned off.

Viewing alarm history details

1. Navigate to **Alarm > Hist**.

2. Select the alarm you want to view (the latest ones appear on top). Press **Detail**.

   NOTE: For unacknowledged high priority alarms, the **Ack** option appears on this screen. Press **Ack** to acknowledge the alarm, or return to the previous screen if you do not want to acknowledge the alarm.

The alarm details show the date and time of the alarm event, the type of event (e.g., dropout or unary), which phase the alarm condition was detected on, and the value that caused the alarm condition to turn ON or OFF.

NOTE: Alarm details are not available if the alarm priority is set to None.

Alarm counter

Every occurrence of each type of alarm is counted and recorded in the meter. To view the alarm counters:

1. Select **Alarm > Count**. The Alarms Counter screen displays.

2. Scroll through the list to view the number of alarm occurrences for each type of alarm.

Rollover value

The alarm counters roll over to zero after reaching the value 9999.

Acknowledging alarms

This applies to high priority alarms. You can use the meter display or software to acknowledge alarms.

To acknowledge alarms using the meter display:

1. Navigate to **Alarm > Unack**.

2. Select the alarm you want to acknowledge. Press **Detail**.

3. Press **Ack** to acknowledge the alarm.

4. Repeat for other unacknowledged alarms.

Active alarms list and alarm history log

Each occurrence of a low, medium or high priority alarm is stored in the active alarms list and recorded in the alarm history log. Alarms are displayed sequentially in the order of their occurrence, regardless of priority.

Alarm memory usage

There are two types of alarm entries: primary and secondary. The primary entry identifies the alarm. The secondary entry provides pickup and dropout information.

The active alarm list holds 40 entries at a time. The list works as a circular buffer, replacing old entries as new entries over 40 are entered into the active alarms list. The information in the active alarms list is volatile and reinitializes when the meter resets.

The alarm history log holds 40 entries. The log also works as a circular buffer, replacing old entries with new entries. The information in the alarm history log is nonvolatile and is retained when the meter resets.

Resetting alarms

To reset the alarms using the meter display, see the alarm parameters under "Single resets" on page 86.

To reset the alarms using ION Setup, open the **Meter Resets** screen and select the alarm parameters to clear.

Related topics

Chapter 11   Multi-tariff feature

This section describes how to set up different tariffs for storing energy values in registers that correspond to each of those tariffs. An example of when this feature can be used is when a utility has set up tariff schedules with different rates based on what day or time of day energy is consumed.

The meter supports configuration of up to 8 different tariffs.

Multi-tariff feature example
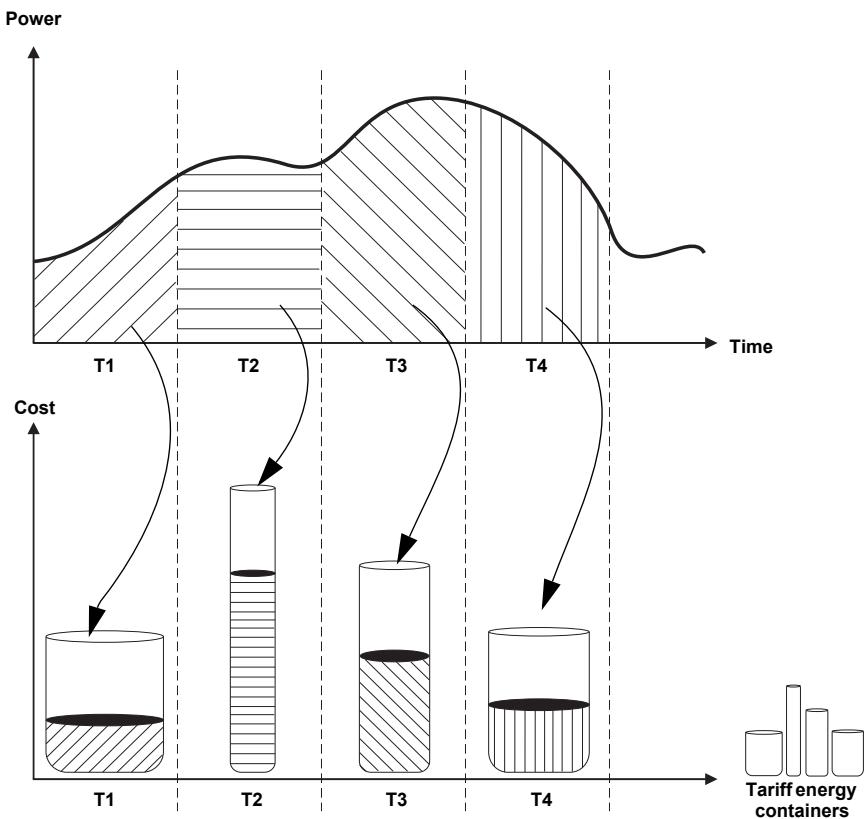
In the above illustration, the area under the power curve equals the energy consumed.

Typically, the utility sets tariff schedules so the cost of energy is higher during high demand or high energy consumption times. How these "tariff energy containers" are configured determines how fast these containers fill, which correlates to increasing energy costs. The price per kWh is lowest at tariff T1 and highest at tariff T2.

Multi-tariff feature overview

The meter supports multiple tariffs to measure and monitor energy usage that can be used in billing or cost applications. There are different tariff modes you can use to determine what tariff is applied and when: Command mode, Time of Day mode, and Input mode.

Command mode overview

You can use this mode to send a Modbus command to the device which sets the active tariff. This tariff is applied to the measured energy until you send another Modbus command that sets a different tariff.

Related topics

- Search your meter's Modbus register list at www.schneider-electric.com to download the Modbus map.

Time of day mode overview

You can use this mode to create a tariff schedule that specifies where the meter stores energy or input metered data, based on the time of year (month, day), the type of day (every day, weekend, weekday or a specific day of the week), or time of day. The data collected from the different tariffs can then be used in energy audits or similar costing and budget planning purposes.

Time format

Multi-tariff configuration using the front panel uses this date and time format:

Front panel date and time format

Parameter	Values	Description
Month	1 to 12	The calendar month, where 1 = January, 2 = February, 3 = March, 4 = April, 5 = May, 6 = June, 7 = July, 8 = August, 9 = September, 10 = October, 11 = November, 12 = December.
Day	1 to 31	The calendar day of the month.
Time	0000 to 2359	The time in 24-hour clock format, where 0000 = 00:00 (12:00 am) and 2359 = 23:59 (11:59 pm).

NOTE: Use ION Setup if you want to configure **Time of Day** tariff using the 12-hour clock (i.e., 12:00 am to 11:59 pm).

Tariff validity

A valid tariff has certain conditions and limitations:

- Each tariff must cover a unique time period (tariffs cannot overlap) but there can be periods with no tariff.
- Any number of tariffs, from none to the maximum number of tariffs, can be applied.
- Time of day tariffs do not adjust for daylight savings time.
- Time of day tariffs include February 29th in leap years (however, it is not recommended to have February 29th as a start or end date, as that tariff would be invalid for non-leap years.
- Except for leap years, tariff dates are not year-specific; if you wanted to create a tariff that starts on the first Monday in August, you need to enter the date for that year, then manually update the tariff information for the subsequent years.

Tariff creation method

Your device performs validation checks as you enter tariff information; it prompts you to change the information that you have entered or set the tariff to disabled if the tariff configuration is invalid. These checks can include:

- Start and end times must be different (for example, you cannot create a tariff that starts at 02:00 and also ends at 02:00).
- Start time can only be earlier than end time for tariffs that are applied every day. You can create a daily tariff that starts at 06:00 and ends at 02:00, but these times are only valid for the **Everyday** tariff and invalid for the other tariff types.
- Start day must be earlier than end day if the days are in the same month. You cannot create a tariff that starts June 15 and ends June 12.

There are two methods of creating tariffs:

- Time of year tariffs divide the year into multiple sections (usually seasons), where each section has one or more day types. For example, an eight tariff configuration using this method could have Spring, Summer, Fall and Winter seasons that also use different weekend and weekday tariffs.
- Daily tariffs can divide days by day of the week, a weekday, a weekend, or every day, and can specify the time of day. For example, an eight tariff configuration could have every day in the year divided into three-hour tariff periods or could have four tariffs for weekends and four tariffs for weekdays.

You can combine these methods if, for example you wanted to create a tariff that applies on Mondays from January 1 to June 30, from 09:00 to 17:00. However, since only one tariff can be applied at any time, you cannot use an everyday or weekday tariff type because you already specified a tariff for the time periods 09:00 to 17:00.

Depending on how you configure the tariffs and the maximum number of tariffs supported by your meter, you may not be able to assign tariffs for the entire year, potentially leaving time gaps that do not have any tariff assigned to them.

Example tariff configurations for an eight-tariff system

In these examples, eight tariffs are used to cover the entire year (there are no time periods that do not have an associated tariff).

Configuration 1: four seasons with weekdays and weekends

Tariff	Type	Start date	End date	Start time	End time[1]
1	Weekend	June 21	September 20	00:00	23:59
2	Weekend	September 21	December 20	00:00	23:59
3	Weekend	December 21	March 20	00:00	23:59
4	Weekend	March 21	June 20	00:00	23:59
5	Weekday	June 21	September 20	00:00	23:59
6	Weekday	September 21	December 20	00:00	23:59
7	Weekday	December 21	March 20	00:00	23:59
8	Weekday	March 21	June 20	00:00	23:59

[1] End time of 23:59 is actually 23:59:59, or just before midnight.

All weekend days fall into one of four different tariffs, depending on the date. All week days fall into one of four different tariffs, depending on the date. This configuration does not use tariffs based on the time of day, or any day types other than weekend or weekday.

Example dates and corresponding tariffs:

- Friday, June 29 = tariff 5
- Sunday, November 18 = tariff 2

Configuration 2: one season for weekends, with off-peak and shoulder hours, two seasons for weekdays, with peak, shoulder and off-peak hours

Tariff	Type	Start date	End date	Start time	End time
1	Every day	January 1	December 31	23:00	04:59
2	Weekdays	May 1	September 30	05:00	06:59
3	Weekdays	May 1	September 30	07:00	19:59
4	Weekdays	May 1	September 30	20:00	22:59
5	Weekdays	October 1	April 30	05:00	06:59
6	Weekdays	October 1	April 30	07:00	19:59
7	Weekdays	October 1	April 30	20:00	22:59
8	Weekends	January 1	December 31	05:00	22:59

All days have a tariff applied between 23:00 and 04:59, corresponding to off-peak hours. All weekend days have a tariff applied from 05:00 to 22:59, corresponding to shoulder hours. All weekdays fall into one of two seasons (summer or winter), and have three tariffs applied throughout the day, corresponding to shoulder and peak hours.

Example dates and corresponding tariffs:

- Wednesday, March 21, 08:00 = tariff 6
- Tuesday, January 10, 21:00 = tariff 7
- Sunday, June 24, 14:00 = tariff 8
- Friday, August 17, 00:00 = tariff 1

Input mode overview

You can use this mode to have the device's digital inputs set which tariff is applied to the energy that is presently being consumed. If a digital input is used for multi-tariff, it cannot be used for an exclusive association (such as Demand Sync or Input Metering), but digital inputs can be shared with a non-exclusive association (such as Alarms). To make a digital input available for setting tariffs, any conflicting associations must be manually removed at the source of the original association.

The number of different tariffs that can be applied is determined by the number of available digital inputs and the total number of tariffs supported by your device. The digital inputs are used as binary counters to identify the appropriate tariff, where off = 0 and on = 1, and most significant bit (MSB) is digital input 4 and least significant bit (LSB) is digital input 1. By this definition, digital input 1 must be associated with the multi-tariff feature in order to set the tariff to **Input** mode.

Digital input requirements for required number of tariffs

Number of tariffs required	Digital inputs required	
	Configuration 1	**Configuration 2**
1	1 (digital input 1)	1 (digital input 1)
2	1 (digital input 1)	2 (digital input 1 and 2)
3	2 (digital input 1 and 2)	2 (digital input 1 and 2)
4	2 (digital input 1 and 2)	3 (digital input 1, 2 and 3)
5	3 (digital input 1, 2 and 3)	3 (digital input 1, 2 and 3)
6	3 (digital input 1, 2 and 3)	3 (digital input 1, 2 and 3)
7	3 (digital input 1, 2 and 3)	3 (digital input 1, 2 and 3)
8	3 (digital input 1, 2 and 3)	4 (digital input 1, 2, 3 and 4)

Configuration 1: 8 tariff assignment using 3 digital inputs[1]

Tariff	Digital input 4	Digital input 3	Digital input 2	Digital input 1
T1	N/A	0	0	0
T2	N/A	0	0	1
T3	N/A	0	1	0
T4	N/A	0	1	1
T5	N/A	1	0	0
T6	N/A	1	0	1
T7	N/A	1	1	0
T8	N/A	1	1	1

[1] There is no inactive tariff with this configuration.

Configuration 2: 8 tariff assignment using 4 digital inputs

Tariff	Digital input 4	Digital input 3	Digital input 2	Digital input 1
None[1]	0	0	0	0
T1	0	0	0	1
T2	0	0	1	0
T3	0	0	1	1
T4	0	1	0	0
T5	0	1	0	1
T6	0	1	1	0
T7	0	1	1	1
T8[2]	1	0	0	0

[1] This digital input configuration (0000) means there are no active tariffs (all tariffs are disabled)

[2] Any configuration above 8, i.e., 1001 and higher, is invalid and therefore ignored by the meter (the active tariff does not change).

Configuring tariffs using the front panel

This section explains how to use the front panel to set up tariffs.

Tariff setup menu tree
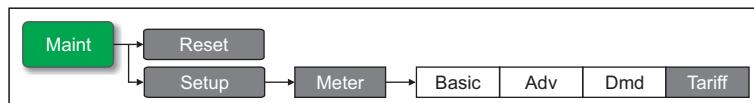
You can change the tariff mode using the front panel.

When the meter is set to command mode for tariffs, the active tariff is controlled by Modbus commands sent from your energy management system or other Modbus master.

Related topics

• Search your meter's Modbus register list at www.schneider-electric.com to download the Modbus map.

Configuring time of day mode tariffs using the front panel

When the meter is set to time of day for tariffs, the active tariff is determined by the day type, the start and end times, and the start and end dates. The time of day tariff is not a calendar; the meter does not calculate the corresponding day of the week to a specific date, but February 29th is considered a valid date if you are programming the meter during a leap year.

When you enter tariff times using the front panel, be aware that the displayed minute value includes the entire minute. For example, an end time of 01:15 includes the time from 01:15:00 through 01:15:59. To create a tariff period that starts right after this, you must set the next tariff's start time to 01:16. Although it may appear that there is a gap between these tariffs, there is not.

1. Navigate to **Maint > Setup**.

2. Enter the setup password (default is "0"), then press **OK**.

3. Navigate to **Meter > Tariff**.

4. With the cursor pointing to **Mode**, press **Edit**.

5. Press **+** or **−** to change the setting to **Time of Day**, then press **OK**.

6. Move the cursor to point to the tariff (Tariff 1 to Tariff 8) you want to modify, then press **Edit**.

Time of day mode tariff setup

Parameter	Values	Description
Month	1 to 12	The calendar month, where 1 = January, 2 = February, 3 = March, 4 = April, 5 = May, 6 = June, 7 = July, 8 = August, 9 = September, 10 = October, 11 = November, 12 = December.
Day Type	Everyday, Weekday, Weekend, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday or Sunday	Select which day the tariff is active. Only tariffs that are Everyday can have a tariff that includes midnight (for instance, from 11pm to 2am).
Start Time	0000 to 2359	Set the time when the tariff period starts, using the 24 hour clock format (00:00 to 23:59). The Start Time cannot equal the End Time.
End Time	0000 to 2359	Set the time when the tariff period ends, using the 24 hour clock format (00:00 to 23:59). The End Time cannot equal the Start Time.
Start Month	1 to 12	Set the month that the tariff period starts, where 1 = January, 2 = February, 3 = March, 4 = April, 5 = May, 6 = June, 7 = July, 8 = August, 9 = September, 10 = October, 11 = November, 12 = December.
Start Day	1 to 31	Set the day of the Start Month that the tariff period starts. The Start Day must be earlier than End Day if Start Month equals End Month.
End Month	1 to 12	The month that the tariff period ends, where 1 = January, 2 = February, 3 = March, 4 = April, 5 = May, 6 = June, 7 = July, 8 = August, 9 = September, 10 = October, 11 = November, 12 = December.
End Day	1 to 31	The day of the End Month that the tariff period ends.

7. Modify each parameter as required, then press **OK** to set. Press ▼ or ▲ to move between parameters.

8. Press ▲ to exit, then **Yes** to save your changes. Repeat for the other tariffs as required. The meter checks the configuration and display a message if any tariffs have conflicting settings (i.e., overlapping tariff periods).

Related topics

- To configure the tariffs and other parameters using ION Setup, see "Meter configuration using ION Setup" on page 53.

Configuring input mode tariffs using the front panel

When you set the tariff type to **Input**, the active tariff is determined by the status of the digital inputs.

Digital inputs are available for tariffs if they are not used, or if they are only associated with alarms (Normal). To make a digital input available, you must manually disconnect the conflicting association before configuring tariffs.

You cannot configure any digital input tariff if digital input 1 is not available for association. Likewise, digital input 2 must be available to select more than two tariffs. The status of the digital inputs is used to calculate the binary value of the active tariff, where off = 0 and on = 1. The calculation of the number of tariffs value can differ, depending on the number of digital inputs that can be selected (i.e., inputs that can be associated with multi-tariff).

To configure input mode tariffs using the front panel:

1. Navigate to **Maint > Setup**.

2. Enter the setup password (default is "0"), then press **OK**.

3. Navigate to **Meter > Tariff**.

4. With the cursor pointing to **Mode**, press **Edit**.

5. Press **+** or **‒** to change the setting to **Input**, then press **OK**.

NOTE: If a digital input association error prompt displays, you must exit from the tariff setup screens and remove the digital input association.

6. Navigate to **Tariffs**, then press **Edit**.

7. Press **+** or **‒** to change the number of tariffs you want to set up. The maximum number of tariffs that you can apply is determined by the number of available digital inputs, as described in the table, "Digital input requirements for required number of tariffs" on page 108. Press **OK**.

8. Navigate to **Inputs**, then press **Edit**.

9. If applicable, press **+** or **‒** to change how many digital inputs you want to use to control which tariff is selected (active). Press **OK**.

10. Press ▲ to exit, then **Yes** to save your changes.

Related topics

• To configure the tariffs using ION Setup, see the "PM5500 series" topic in the ION Setup online help or in the *ION Setup device configuration guide*, available for download at www.schneider-electric.com.

Chapter 12   Measurements and calculations

This section describes how the power meter processes measured and calculated data.

Real-time readings

The power meter measures currents and voltages, and reports in real time the RMS (Root Mean Squared) values for all three phases and neutral. The voltage and current inputs are continuously monitored at a sampling rate of 128 points per cycle. This amount of resolution helps enable the meter to provide reliable measurements and calculated electrical values for various commercial, buildings and industrial applications.

Related topics

- See "Introduction" on page 11 to learn about the meter's capabilities.
- See "Viewing meter data" on page 63 to learn how to navigate the data screens using the front panel.
- See "Using software to view meter data" on page 69 for information on energy management software systems.

Energy

The power meter calculates and stores accumulated energy values for real, reactive, and apparent energy.

You can view accumulated energy from the display. The energy value units automatically change, based on the quantity of energy accumulated (e.g., from kWh to MWh, then from MWh to TWh).

Related topics

- See "Energy" on page 12 for a list of energy readings.
- See "Energy" on page 65 to view energy readings using the meter display.
- See "Using software to view meter data" on page 69 for information on energy management software systems.

Min/max values

The meter's real-time readings are updated once every 50 cycles for 50 Hz systems, or once every 60 cycles for 60 Hz systems. When the readings reach their lowest or highest value, the meter updates and saves these min/max (minimum and maximum) quantities in non-volatile memory.

Power factor

Power factor (PF) is the ratio of real power (P) to apparent power (S), and is a number between zero (0) and one (1). In a purely resistive circuit, PF is equal to 1 (unity PF). Inductive or capacitive loads increase the reactive power (Q) component in the circuit which causes the PF to become less than 1.

Power factor can have a positive or negative sign, depending on the type of load or direction of power flow. See "Power factor sign convention" on page 114.

Power factor min/max convention

The meter uses the following convention for power factor minimums and maximums:

- For negative PF readings, the minimum PF value is the measurement closest to -0 for PF readings between -0 to -1. For positive PF readings, the minimum PF value is the measurement closest to +1 for PF readings between +1 to +0.

- For negative PF readings, the maximum PF value is the measurement closest to -1 for PF readings between -0 to -1. For positive PF readings, the maximum PF value is the measurement closest to +0 for PF readings between +1 to +0.

Power factor minimum and maximum
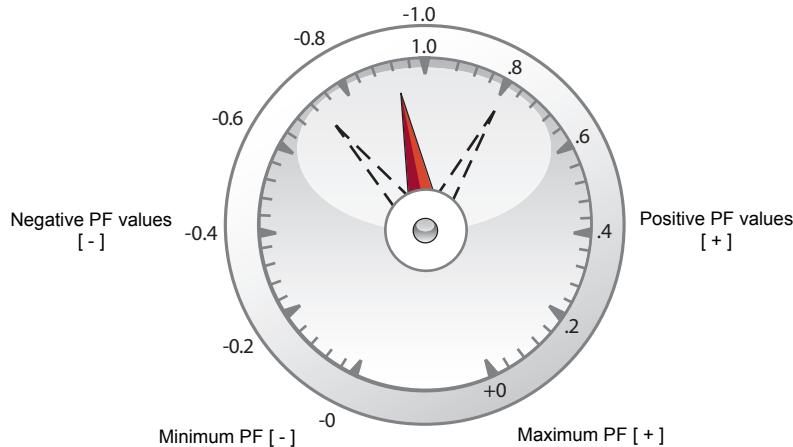
Power factor sign convention

You can set the power factor sign (PF sign) convention by changing the HMI mode to either IEC or IEEE.

Power factor sign convention

IEC mode

In IEC mode, the PF sign follows the direction of power flow. PF sign is positive (+) for positive (normal) power flow. PF sign is negative (-) for negative (reverse) power flow.

IEEE mode

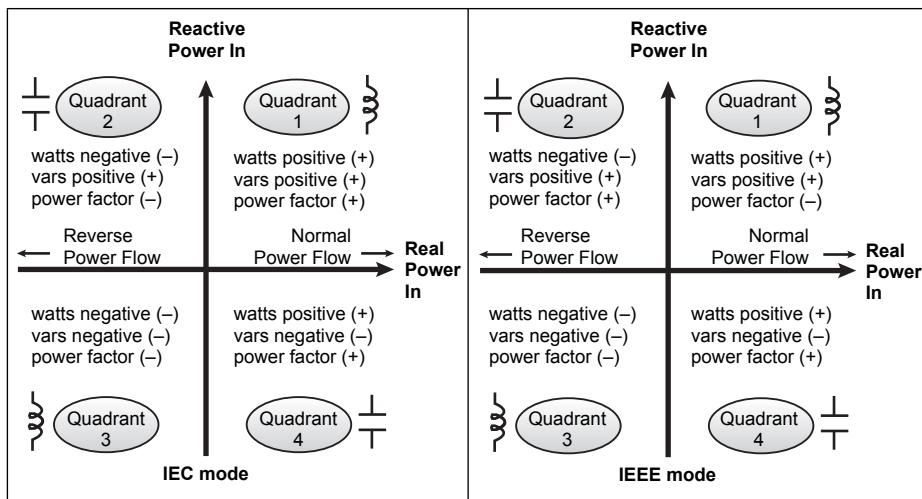In IEEE mode, the PF sign is determined by the type of load (inductive or capacitive) contributing to the reactive power component of apparent power. PF sign is positive (+) for capacitive loads (leading power factor). PF sign is negative (-) for inductive loads (lagging power factor).

Related topics

- See "Setting up regional settings" on page 44 to change the HMI mode.
- See "Power, energy and power factor" on page 139 to learn how the meter calculates power factor.

Power demand

Power demand is a measure of average power consumption over a fixed time interval.

NOTE: If not specified, references to "demand" is assumed to mean "power demand".

The meter measures instantaneous consumption and can calculate demand using various methods.

Related topics

- See "Demand setup" on page 40 to set up demand using the front panel.

Power demand calculation methods

Power demand is calculated by dividing the energy accumulated during a specified period by the length of that period. How the power meter performs this calculation depends on the method and time parameters you select (for example, timed rolling block demand with a 15-minute interval and 5-minute subinterval).

To be compatible with electric utility billing practices, the power meter provides the following types of power demand calculations:

- Block interval demand
- Synchronized demand
- Thermal demand

You can configure the power demand calculation method from the front panel or using ION Setup.

Block interval demand

For block interval demand method types, you specify a period of time interval (or block) that the power meter uses for the demand calculation. Select/configure how the power meter handles that interval from one of these different methods:

- **Timed Sliding Block**: Select an interval from 1 to 60 minutes (in 1-minute increments). If the interval is between 1 and 15 minutes, the demand calculation *updates every 15 seconds*. If the interval is between 16 and 60 minutes, the demand calculation *updates every 60 seconds*. The power meter displays the demand value for the last completed interval.
- **Timed Block**: Select an interval from 1 to 60 minutes (in 1-minute increments). The power meter calculates and updates the demand at the end of each interval.
- **Timed Rolling Block**: Select an interval and a subinterval. The subinterval must divide evenly into the interval (for example, three 5-minute subintervals for a 15-minute interval). Demand is *updated at the end of each subinterval*. The power meter displays the demand value for the last completed interval.

The following illustration shows the different ways power demand is calculated using the block interval method. In this example, the interval is set to 15 minutes.

Block interval demand example

Calculation updates every 15 seconds

15-minute interval

Demand value is the average for the last completed interval

Time (sec)

15 30 45 60 . . .

Timed Sliding Block

Calculation updates at the end of the interval

Demand value is the average for the last completed interval

15-minute interval

15-minute interval

15-min

Time (min)

15   30   45

Timed Block

Calculation updates at the end of the subinterval (5 minutes)

Demand value is the average for the last completed interval

15-minute interval

Time (min)

15   20   25   30   35   40   45

Timed Rolling Block

Synchronized demand

You can configure the demand calculations to be synchronized using an external pulse input, a command sent over communications, or the device's internal real-time clock.

- **Input synchronized demand:** This method allows you to synchronize the demand interval of your meter with an external digital pulse source (such as another power meter's digital output) connected to your meter's digital input. This helps synchronize your meter to the same time interval as the other meter for each demand calculation. When setting up this type of demand, you can choose **Input Sync Block** (input-synchronized block demand) or **Input Sync Roll Blk** (input-synchronized rolling block demand). **Input Sync Roll Blk** requires that you specify a subinterval.

- **Command synchronized demand:** This method allows you to synchronize the demand intervals of multiple meters on a communications network. For example, if a programmable logic controller (PLC) input is monitoring a pulse at the end of a demand interval on a utility revenue meter, you can program the PLC to issue a command to multiple meters whenever the utility meter starts a new demand interval. Each time the command is issued, the demand readings of each meter are calculated for the same interval. When setting up this type of demand, you can

choose **Cmd Sync Block** (command-synchronized block demand) or **Cmd Sync Roll Block** (command-synchronized rolling block demand). **Cmd Sync Roll Blk** requires that you specify a subinterval.

- **Clock synchronized demand:** This method allows you to synchronize the demand interval to the power meter's internal real-time clock. This helps you synchronize the demand to a particular time, typically on the hour (for example, at 12:00 am). If you select another time of day when the demand intervals are to be synchronized, the time must be specified in minutes from midnight. For example, to synchronize at 8:00 am, select 480 minutes. When setting up this type of demand, you can choose **Clock Sync Block** (clock-synchronized block demand) or **Clock Sync Roll Blk** (clock-synchronized rolling block demand). **Clock Sync Roll Blk** requires that you specify a subinterval.

Thermal demand

Thermal demand calculates the demand based on a thermal response, which imitates the function of thermal demand meters. The demand calculation updates at the end of each interval. You can set the demand interval from 1 to 60 minutes (in 1-minute increments).

The following illustration shows the thermal demand calculation. In this example, the interval is set to 15 minutes.

Thermal demand example

Calculation updates at the end of each interval
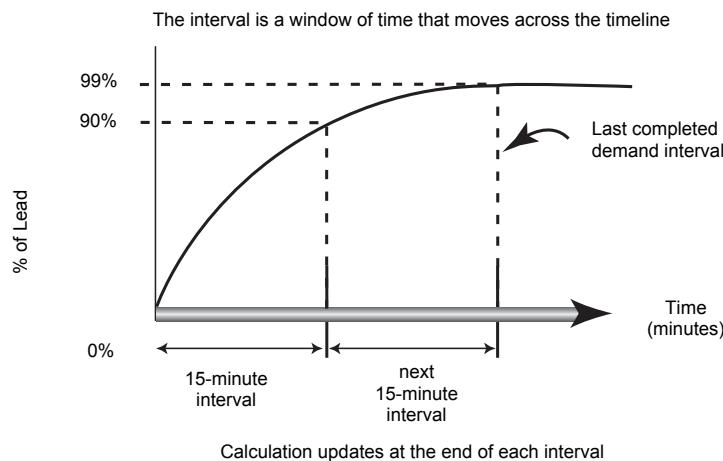
Current demand

The power meter calculates current demand using one of the methods described in "Power demand calculation methods" on page 115. You can set the demand interval from 1 to 60 minutes in 1-minute increments (for example, 15 minutes).

Predicted demand

The power meter calculates predicted demand for the end of the present interval for kW, kVAR, and kVA demand. This prediction takes into account the energy consumption so far within the present (partial) interval and the present rate of consumption.

Predicted demand is updated every second.

The following illustration shows how a change in load can affect predicted demand for the interval. In this example, the interval is set to 15 minutes.

Predicted demand example
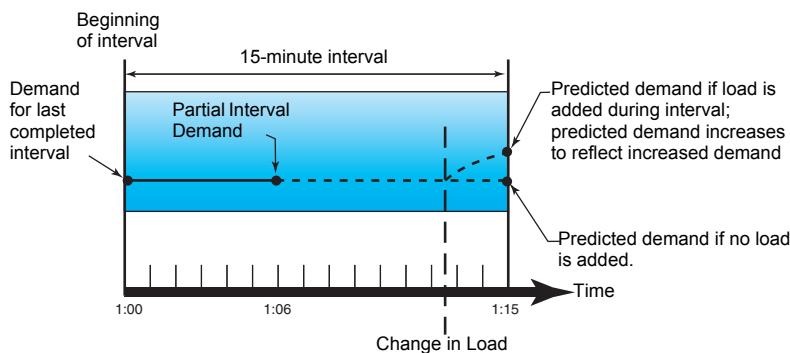
Peak demand

The maximum values for the kWD, kVARD, and kVAD power (or peak demand) is maintained in the meter's non-volatile memory. The peak for each value is the highest average reading since the meter was last reset. The power meter also stores the date and time when the peak demand occurred. In addition to the peak demand, the power meter also stores the coinciding average 3-phase power factor. The average 3-phase power factor is defined as "demand kW/demand kVA" for the peak demand interval.

Related topics

- See "Demand" on page 12 for a list of available peak demand readings.
- See "Single resets" on page 86 to reset peak demand values using the meter display.

Input metering demand

The power meter supports up to 4 input metering channels, one for each digital input. The input metering channels can be used to measure water, air, gas, electric and steam utilities (WAGES).

Typical WAGES utility meters have no communications capabilities, but they usually have a pulse output. The utility meter sends a pulse to its output each time a preset quantity or amount of (WAGES) energy is consumed or delivered. This preset quantity or amount is referred to as the pulse weight.

To monitor the utility meter, connect its pulse output to the power meter's digital input. Use ION Setup to associate the digital input for input metering and configure the input metering operation mode, pulse weight, consumption units and demand units.

Related topics

- See "Digital input setup" on page 72 for details on configuring the digital inputs.
- See "Input metering setup" on page 75 for details on configuring input metering.

Timer

The meter supports an active load timer and an operating timer. Use the meter display to navigate to the Timer screens.

Operating timer

The operating timer (**Timer > Oper**) keeps track of how long the meter has been powered up.

Load timer

The load timer keeps track of how much time the input current exceeds the specified load timer setpoint current.

Related topics

• See "Configuring advanced setup parameters" on page 39 to set up the minimum current for the load timer setpoint.

Chapter 13   Power quality

This section describes the meter's power quality features and how to access power quality data.

The meter measures voltage and current harmonics up to the 63rd harmonic, and calculates Total Harmonic Distortion (THD) and Total Demand Distortion (TDD and tdd).

Harmonics overview

Harmonics are integer multiples of the fundamental frequency of the power system. Harmonics information is valuable for power quality analysis, determining properly rated transformers, maintenance and troubleshooting.

Harmonics measurements include per-phase magnitudes and angles for the fundamental and higher harmonics relative to the fundamental frequency. The meter's power system setting defines which phases are present and determines how line-to-line or line-to-neutral voltage harmonics and current harmonics are calculated.

Harmonics data provide information to determine how non-linear loads affect the power system. For example, power system harmonics can cause current flow on the neutral conductor, increase heating in electric motors, and eventually damage connected equipment. Power conditioners or harmonic filters can be used to minimize unwanted harmonics.

Crest factor and K-factor

Crest factor is the ratio of peak to RMS voltage values. For a pure sinusoidal waveform, crest factor is equal to 1.414. The meter uses the following equation to calculate crest factor:

$$\text{Crest factor} = \frac{V_{peak}}{V_{RMS}}$$

K-factor relates the heating effect of a distorted current in a transformer to a sinusoidal current with the same RMS magnitude — it describes a transformer's ability to serve non-linear loads without exceeding rated temperature rise limits. The K-factor is equal to the sum of the squares of the harmonic currents multiplied by the squares of the harmonic order. The meter uses the following equation to calculate K-factor:

$$\text{K-factor} = \sum_{h=1}^{\infty} (Ih^2 \times h^2)$$

Where `h` is the harmonic order and `Ih` is the true RMS current of harmonic order `h`.

Total Harmonic Distortion and Total Demand Distortion

Total Harmonic Distortion (THD) is a measure of the total per-phase voltage or current harmonic distortion present in the power system. It provides a general indication of the quality of a waveform. THD is calculated for each phase of both voltage and current.

Total Demand Distortion (TDD) is the per-phase harmonic current distortion against the full load demand of the electrical system. TDD indicates the impact of harmonic distortion in the system. For example, if your system is showing high THD values but a

low demand, the impact of harmonic distortion on your system might be insignificant. However at full load, the THD value for the current harmonics is equal to TDD, so this could negatively impact your system.

The meter uses the following series of equations to calculate THD and TDD.

Harmonic content calculations

1. Calculate harmonic content (HC).

$$HC = \sqrt{(H2)^2 + (H3)^2 + (H4)^2 \dots}$$

`HC` (harmonic content) is equal to the RMS value of all the non-fundamental harmonic components in one phase of the power system.

2. Calculate the harmonic content for current (HCI).

$$HCI = \sqrt{(HI2)^2 + (HI3)^2 + (HI4)^2 \dots}$$

`HCI` (harmonic content current) is equal to the RMS value of all the non-fundamental current harmonic components (`HI2…HIn`) in one phase of the power system.

THD and thd calculations

The meter supports two methods of calculating total harmonic distortion: THD and thd.

THD is a quick measure of the total distortion present in a waveform and is the ratio of harmonic content to the fundamental. The meter uses the following equation to calculate THD:

$$THD = \frac{HC}{H1} \times 100$$

Where `H1` is equal to the fundamental harmonic.

thd is an alternate method for calculating total harmonic distortion. It uses the RMS value for the total harmonic content rather than the fundamental content. The meter uses the following equation to calculate thd:

$$thd = \frac{HC}{\sqrt{(H1)^2 + (HC)^2}} \times 100$$

TDD calculation

TDD (total demand distortion) evaluates the harmonic currents between an end user and a power source. The harmonic values are based on a point of common coupling (PCC), which is a common point where each user receives power from the power source. The meter uses the following equation to calculate TDD:

$$TDD = (\sqrt{(HCIA)^2 + (HCIB)^2 + (HCIC)^2}) / (ILoad) \times 100$$

Where `ILoad` is equal to the maximum demand load on the power system.

Displaying harmonics data

For meters equipped with a front panel display, the following harmonics data is available:

- Numeric magnitude and angle of the fundamental (first) harmonic.
- Graphical display of the 3rd to 31st harmonics, expressed as a percentage of the fundamental harmonic.

Viewing harmonics using the front panel

You can view harmonics data using the front panel.

1. Navigate to **Harm**. The Harmonics % screen displays, with the following menu options:

   Harmonics % display screens

IEEE mode	IEC mode	Description
V L-L	U	Line-to-line voltage harmonics data
V L-N	V	Line-to-neutral voltage harmonics data
Amps	I	Current harmonics data
TDD/K	TDD/K	Total demand distortion and K-factor data
Crest	Crest	Crest factor data

2. Press the voltage or current harmonics you want to view. The fundamental (1st) harmonic's numeric magnitudes and angles for all phases are displayed.

3. Press **3-11, 13-21**, or **23-31** to view the graphs for the 3rd to 11th, 13th to 21st, or 23rd to 31st harmonics, respectively. For example, to display the 13th to 21st harmonics screen, press **13-21**.

   Example: 13th to 21st harmonics for line-to-neutral voltage
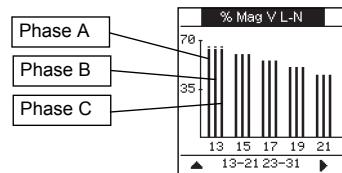
   The vertical axis of the harmonics graph indicates the harmonic's magnitude as a percentage of the fundamental harmonic, and is scaled based on the largest harmonic displayed. At the top of each vertical bar is a marker that shows the maximum value of the harmonic. If the harmonic is greater than the fundamental harmonic, this marker is triangular-shaped to show that the value is out of range.

   NOTE: The display screen only shows odd harmonics up to the 31st harmonic. However, all individual odd and even harmonics data up to the 63rd harmonic is available through communications and software. Individual harmonics data include current harmonics per phase, neutral and ground, and voltage harmonics line-to-line, line-to-neutral and neutral to ground.

Viewing TDD, K-factor and Crest factor data

1. Navigate to **Harm > TDD/K**. The TDD and K-factor per phase information displays.

   Power Quality display screens

IEEE mode	IEC mode	Description
TDD	TDD	Total demand distortion
K-F A	K-F A	K factor for phase A

Power Quality display screens (Continued)

IEEE mode	IEC mode	Description
K-F B	K-F B	K factor for phase B
K-F C	K-F C	K factor for phase C

2. Navigate to **Harm > Crest**. The Crest factor information displays.

Crest Factor display screens

IEEE mode	IEC mode	Description
V L-L	U	Crest factor data for line-to-line voltage
V L-N	V	Crest factor data for line-to-neutral voltage
Amps	I	Crest factor data for current

3. Press ▲ to return to the main display screens.

   NOTE: Your meter's Modbus map includes registers for harmonics data for integration into your power or energy management system.

Related topics

- See "Front panel display and meter setup" on page 33 for front panel menu navigation details.
- Search your meter's Modbus register list at www.schneider-electric.com to download the Modbus map.

Viewing THD/thd using the front panel

You can view THD/thd data using the front panel.

1. Navigate to **THD**. On the THD/thd Select screen, press **THD** to display values that use the calculation method based on the fundamental harmonic, or **thd** to display values that use the calculation method based on the RMS value of all harmonics in that phase (including the fundamental).

THD (or thd) display screens

IEEE mode	IEC mode	Description
Amps	I	Total harmonic distortion data for per phase and neutral currents.
V L-L	U	Total harmonic distortion data line-to-line voltage.
V L-N	V	Total harmonic distortion data line-to-neutral voltage.

2. Press the current or voltage THD or thd values you want to view. The total harmonic distortion percentage values are displayed.

3. Press ▲ to return to the main display screens.

NOTE: Your meter's Modbus map includes registers for total harmonic distortion data for integration into your power or energy management system.

Related topics

- See "Front panel display and meter setup" on page 33 for front panel menu navigation details.
- Search your meter's Modbus register list at www.schneider-electric.com to download the Modbus map.

Chapter 14 Maintenance and upgrades

This section describes maintenance information and upgrade procedures for the meter.

> ## ⚠ DANGER
>
> **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**
>
> - Do not attempt to service the meter. CT and PT inputs may contain hazardous currents and voltages.
> - Do not perform a dielectric (hi-pot) or Megger test on the meter. High voltage testing of the meter may damage it.
> - Before performing hi-pot or Megger testing on any equipment in which the meter is installed, disconnect all input and output wires to the meter.
>
> **Failure to follow these instructions will result in death or serious injury.**

Maintenance

The meter does not contain any user-serviceable parts. There are no moving parts inside the meter that require cleaning.

- Do not open the meter. Opening the meter will void the warranty.
- Only manufacturer-authorized service personnel should service the meter.

Contact your local sales representative or Technical Support if the meter requires servicing.

Wrench icon

The wrench icon ⚊ appears on the top corner of the display screen to alert you of an overvoltage condition or a potential hardware or firmware problem in the meter that requires attention.

Navigate to **Maint > Diag > Meter** to view details of the meter status. Make note of the information shown on the screen, then contact Technical Support.

Troubleshooting LED indicators

Abnormal heartbeat / serial communications LED behavior could mean potential problems with the meter.

Heartbeat / serial communications LED behavior

Problem	Probable causes	Possible solutions
LED flash rate does not change when data is sent from the host computer.	Communications wiring	If using a serial-to-RS-485 converter, trace and check that all wiring from the computer to the meter is properly terminated.
	Internal hardware problem	Perform a hard reset: turn off control power to the meter, then re-apply power. If the problem persists, contact Technical Support.
Heartbeat / serial communications LED remains lit and does not flash ON and OFF	Internal hardware problem	Perform a hard reset: turn off control power to the meter, then re-apply power. If the problem persists, contact Technical Support.
Heartbeat / serial communications LED flashes, but the display is blank	Display setup parameters incorrectly set	See "Setting up the display" on page 44.

If the problem is not fixed after troubleshooting, contact Technical Support for help. Make sure you have your meter's firmware version, model and serial number information available.

Meter memory

The meter uses its non-volatile memory (NVRAM) to retain all data and metering configuration values. Under the operating temperature range specified for the meter, the NVRAM has an anticipated life of 45 years or longer. The meter stores its data logs in a memory chip, which has a life expectancy of up to 20 years under the operating temperature range specified for the meter.

Clock battery

The internal battery in the meter keeps its clock running and helps maintain the time even when the meter is powered down.

The life expectancy of the internal battery is estimated to be over 10 years at 25°C under typical operating conditions.

Firmware version, model and serial number

You can view the meter's firmware version, model and serial number from the display panel or through the meter webpages:

- Using the display panel: Navigate to **Maint > Diag > Info**. See "Maintenance" on page 68 for details.
- Using the meter webpages: Navigate to **Diagnostics > Meter**. See "Diagnostics" on page 59 for details.

Firmware upgrade

To see if there are firmware upgrades available for your meter, search your meter at www.schneider-electric.com.

Reasons for upgrading your meter's firmware include the following:

- Improve meter performance (e.g., optimize processing speed)
- Enhance existing meter features and functions
- Add new functionality to the meter
- Achieve compliance to stricter industry standards

The meter contains firmware that can be upgraded using the following methods:

Meter firmware and upgrade method

Firmware type	Upgrade method	Description
OS	DLF3000	The OS (operating system) firmware contains code that controls the meter's features.
Language	DLF3000	The language file contains translation strings to set the meter's display to the selected language.
FPGA app	DLF3000	The FPGA app (field programmable gate array application) firmware provides seamless transition between the meter's physical hardware and the firmware code.
Ethernet	FTP	The Ethernet files control how the meter webpages are displayed. The files in the FW folder contains the code and initialization files to run Ethernet communications. The www folder contains the webpages and javascript files.

Using DLF300 to upgrade firmware

1. Download the latest version of DLF3000 from www.schneider-electric.com, then install it on your computer.

   NOTE: DLF3000 is a free Schneider Electric utility for downloading firmware to your meter.

2. Download your meter's firmware from www.schneider-electric.com.

3. Start DLF3000.

4. Click **Add**. Navigate to the folder where you saved your meter's firmware.

5. Select the firmware file and click **Open**.

6. Select the firmware, then click **Next**.

7. If you haven't defined an upgrade system yet:

   — Click **New**, then type in the box to assign a system name
   — Click **Add**, then type in the box to assign a communications connection name
   — Select the communications driver (Modbus/TCP Driver or Serial Driver)

8. Click **Continue**.

9. If you are using Modbus over TCP to upgrade, type the meter's IP address in the box, then click **OK**.

10. Click **Add Device**.

    — Type in the box to assign a device name
    — Select the device type from the list
    — Select the connection name, i.e., the one you defined in the previous step.

11. Click **Next**.

12. Make sure the connection name, i.e., the one you defined in the previous step, is still selected. Enter the device address.

13. Select the protocol (e.g., Modbus).

14. Click **OK**.

15. Click **Next**.

16. Select the device name from the **Download Candidate Devices** pane, then click the right arrow button to move the selection to the **Download Target Devices** pane.

17. Select the meter firmware in the **Firmware to** field.

18. Click **Next**.

19. Click **Health Check** to confirm the meter is communicating. The Health Status shows **Passed** to indicate successful communications.

20. Click **Next**.

21. The Firmware Update Group shows the connection name, the firmware version and status (should be "Queued"). The Group Device List shows the device or devices being upgraded. Click **Download**.

NOTE: A warning message displays, "Warning: Relays on PowerLogic Metering Devices will be de-energized if selected for download and will remain in this mode until a successful download is completed. Press **OK** to start the download."

22. Click **OK**.

    — The Firmware Upgrade Group status changes to Active, then updates to show the current upgrade progress (in percent complete).
    — The Group Device List status shows "Entering Download Mode", then changes to "Downloading" when the firmware is being downloaded to the meter. "Estimated Time Remaining" shows the firmware download progress.

— You can also check the progress on meters equipped with a display panel. The meter display shows "Download in progress" and a shows a dynamically incrementing number for "Percent Complete" (up to 100%).

23. When the firmware upgrade is complete, the Firmware Update Group status shows Complete (Passed). The Group Device List status shows Successful Download. Click **Finished**.

24. To exit the download firmware program, click **Yes** when prompted to quit DLF.

Upgrading the Ethernet card

The Ethernet card is the hardware component in your meter that is responsible for Ethernet communications. The Ethernet files are contained in two folders: FW and www:

- FW contains the code and other initialization files that run Ethernet communications.
- www contains the webpages and java script files. You can add custom webpages or modify the existing ones in this folder.

To upgrade your Ethernet card firmware, use an FTP client, such as FileZilla.

1. Start your FTP client.

2. Click **Edit > Settings**.

3. In the tree view, click **Transfers > File Types**.

4. Set Default transfer type to **Binary**, then click **OK**.

5. Type the meter's IP address in the **Host** field and log in using your credentials. The factory default settings are:

    — Username = user2

    — Password = pass2

6. You may leave the Port field blank (the default FTP port setting is 21). Click **Quickconnect**.

7. In the local site pane, navigate to the folder where you downloaded the communications card firmware, then open the FW folder.

8. Navigate to the FW folder in the remote site pane (i.e., the meter).

9. Select all files in the FW folder from the local site, then upload it to the FW folder on the remote site.

10. If prompted that the target file already exists, select or confirm to overwrite the target file. Select **Apply to current queue only** if this option exists in the FTP client you are using.

11. Repeat the previous file transfer steps, this time selecting all files in the www folder.

12. Exit the ftp client afer the file transfer completes successfully.

Technical assistance

For assistance with lost passwords and other technical problems with the meter, contact Technical Support:

- Global-PMC-Tech-support@schneider-electric.com
- (00) + 1 (250) 544-3010

Make sure you include your meter's model, serial number and firmware version in your email or have it readily available if calling Technical Support.

Diagnostics screen

For meters equipped with a display screen, you can use the Diagnostics screens to obtain information that may help you troubleshoot meter problems.
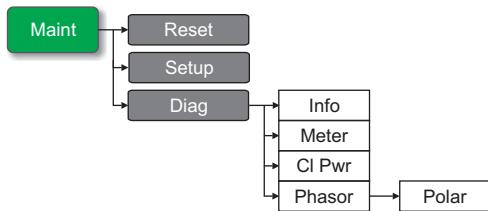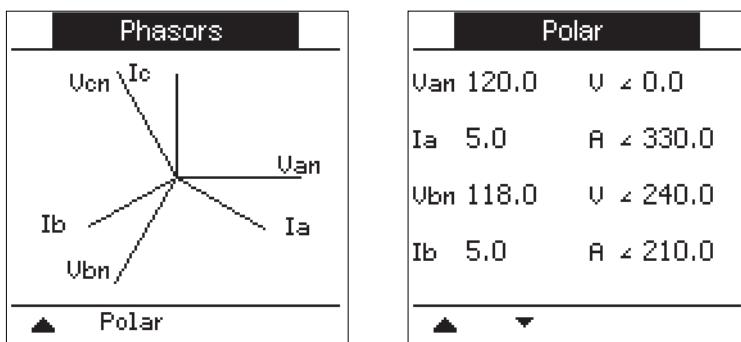

Info, Meter and CI Pwr

See "Maintenance" on page 68 for description of the Info (information), Meter and CL Pwr (loss of control power) diagnostics screens.

Phasors

Phasors are used to represent the voltage and current magnitudes and phase angles.

The graph on the Phasors screen shows a representation of the phase angles in degrees, with the size of the lines representing the relative RMS magnitude of the voltages with respect to the other phase voltages, and the currents with respect to the other phase currents. The phasor for phase A voltage is set to a phase angle of zero, and all other phase angles are measured relative to phase A.

The Polar screen shows the RMS value and phase angle of each voltage and current phases.

Phasors can be used to troubleshoot incorrect connections on the meter's voltage and current inputs. The phasors can reveal switched phase wiring or polarity errors.

NOTE: If two phasor lines overlap (i.e. if they have the same relative phase angle), only one phase label is visible as phasor diagram labels are overwritten dynamically on the display panel.

Maintenance log

The meter's maintenance log can be accessed using the webpages. See "Diagnostics" on page 59.

Chapter 15   Verifying accuracy

All meters are tested and verified at the factory in accordance with International Electrotechnical Commission (IEC) and American National Standards Institute (ANSI) standards.

Your digital power meter does not require re-calibration. However, in some installations a final accuracy verification of the meters is required, especially if the meters will be used for revenue or billing applications.

Testing overview

The most common method for testing meter accuracy is to apply test voltages and currents from a stable power source and compare the meter's readings with readings from a reference device or energy standard.

Accuracy test requirements

Signal and power source

The meter maintains its accuracy during voltage and current signal source variations but its energy pulsing output needs a stable test signal to help produce accurate test pulses. The meter's energy pulsing mechanism needs approximately 10 seconds to stabilize after every source adjustment.

The meter must be connected to control power in order to conduct accuracy verification testing. Refer to your meter's installation documentation for power supply specifications.

> ### ⚠ DANGER
>
> **HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH**
>
> Verify the device's power source meets the specifications for your device's power supply.
>
> **Failure to follow these instructions will result in death or serious injury.**

Control equipment

Control equipment is required for counting and timing the pulse outputs from the alarm / energy pulsing LED or the digital outputs.

• Most standard test benches have an arm equipped with optical sensors to detect LED pulses (the photodiode circuitry converts detected light into a voltage signal).
• The reference device or energy standard typically has digital inputs that can detect and count pulses coming from an external source (i.e., the meter's digital output).

NOTE: The optical sensors on the test bench can be disrupted by strong sources of ambient light (such as camera flashes, florescent tubes, sunlight reflections, floodlights, etc). This can cause test errors. Use a hood, if necessary, to block out ambient light.

Environment

The meter should be tested at the same temperature as the testing equipment. The ideal temperature is about 23 °C (73 °F). Make sure the meter is warmed up sufficiently before testing.

A warm-up time of 30 minutes is recommended before beginning energy accuracy verification testing. At the factory, the meters are warmed up to their typical operating temperature before calibration to help ensure that the meters will reach their optimal accuracy at operating temperature.

Most high precision electronic equipment requires a warm up time before it reaches its specified performance levels. Energy meter standards allow the manufacturers to specify meter accuracy derating due to ambient temperature changes and self-heating.

Your meter complies with and meets the requirements of these energy metering standards.

For a list of accuracy standards that your meter complies to, contact your local Schneider Electric representative or download the meter brochure from www.schneider-electric.com.

Reference device or energy standard

To help ensure the accuracy of the test, it is recommended that you use a reference device or reference energy standard with a specified accuracy that is 6 to 10 times more accurate than the meter under test. Before you start testing, the reference device or energy standard should be warmed up as recommended by its manufacturer.

NOTE: Verify the accuracy and precision of all measurement equipment used in accuracy testing (for example, voltmeters, ammeters, power factor meters).

Energy pulsing

You can configure the meter's alarm /energy LED or one of the digital outputs for energy pulsing.

• The meter is equipped with an alarm / energy pulsing LED. When configured for energy pulsing, the LED emits pulses that are then used to determine the accuracy of the meter's energy measurements.

Location of energy pulsing LED

| PM5560 | PM5563 | A | Alarm / energy pulsing LED |
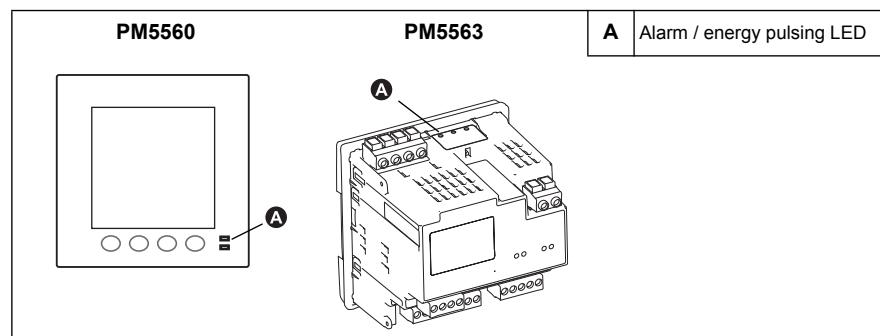
• The meter is equipped with digital outputs. When you configure a digital output for energy pulsing, the meter sends voltage pulses to the digital output port, which are then used to determine the accuracy of the meter's energy measurements.

Related topics

• See "Energy pulsing" on page 81 for configuration instructions using the front panel or ION Setup.

Verifying accuracy test

The following are guidelines for testing the meter; your meter shop may have specific testing methods.

> ### ⚠ DANGER
>
> **HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH**
>
> - Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA or applicable local standards.
> - Turn off all power supplying this device before working on it.
> - Always use a properly rated voltage sensing device to confirm that all power is off.
> - Do not exceed the device's ratings for maximum limits.
> - Verify the device's power source meets the specifications for your device's power supply.
>
> **Failure to follow these instructions will result in death or serious injury.**

1. Turn off power to all test equipment. Use a properly rated voltage sensing device to confirm power is off.

2. Connect the test voltage and current source to the reference device or energy standard. Ensure all voltage inputs to the meter under test are connected in parallel and all currents inputs are connected in series.

    Connecting the meter to the reference standard and test equipment
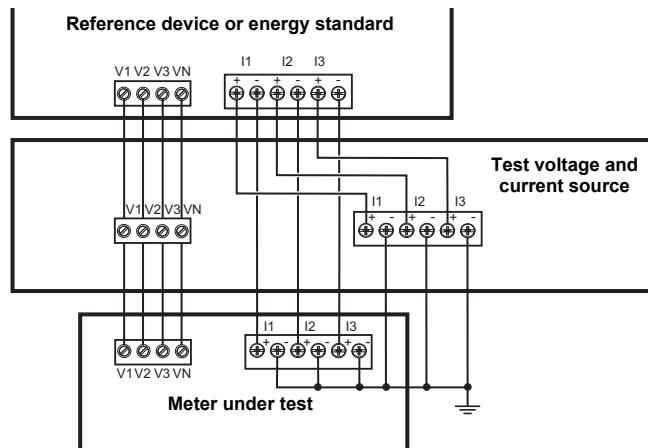
3. Connect the control equipment used for counting the standard output pulses using one of these methods:

Alarm / energy LED	Align the red light sensor on the standard test bench armature over the front panel alarm / energy LED.
Digital output	Connect the meter's digital output to the standard test bench pulse counting connections.

    NOTE: When selecting which method to use, be aware that the Alarm / energy LED and digital outputs have different pulse rate limits. See "Energy pulsing considerations" on page 135 for details.

4. Before performing the verification test, let the test equipment power up the meter and apply voltage for at least 30 seconds. This helps stabilize the internal circuitry of the meter.

5. Set the meter's power system to 3PH4W Wye Gnd (3-phase, 4 wire Wye with ground).

6. Depending on the method selected for counting the energy pulses, configure the meter's alarm / energy LED or one of the digital outputs to perform energy pulsing. Set the meter's energy pulse constant so it is in sync with the reference test equipment.

7. Perform accuracy verification on the test points. Run each test point for at least 30 seconds to allow the test bench equipment to read an adequate number of pulses. Allow 10 seconds of dwell time between test points.

Calculating the number of required pulses

The reference test equipment typically requires you to specify the number of pulses required for a test duration of "t" seconds. Normally, the number of pulses required is at least 25 pulses, and the test duration is greater than 30 seconds.

Use the following formula to calculate the required number of pulses:

$$\text{Number of pulses} \ = \ \text{Ptot} \times \text{K} \times \frac{t}{3600}$$

Where:

- Ptot = total instantaneous power in kilowatts (kW)
- K = the meter's pulse constant setting, in pulses per kWh
- t = test duration, in seconds (typically greater than 30 seconds)

Calculating total power

The test voltage and current source supplies the same test signals to both the energy reference/standard and the meter under test. Total power is calculated as follows:

For a balanced 3-phase Wye system:

$$\text{Ptot} \ = \ 3 \times \text{VLN} \times \text{I} \times \text{PF} \times \frac{1 \text{ kW}}{1000 \text{ W}}$$

NOTE: A balanced 3-phase system assumes the voltage, current and power factor values are the same for all phases.

For a single-phase system:

$$\text{Ptot} \ = \ \text{VLN} \times \text{I} \times \text{PF} \times \frac{1 \text{ kW}}{1000 \text{ W}}$$

Where:

- Ptot = total instantaneous power in kilowatts (kW)
- VLN = test point line-to-neutral voltage in volts [V]
- I = test point current in amps [A]
- PF = power factor

The result of the calculation is rounded up to the nearest integer.

Percent error calculation

For every test point:

$$\text{Energy Error} \ = \ \frac{\text{EM} - \text{ES}}{\text{ES}} \times 100\%$$

Where:

- EM = energy measured by the meter under test
- ES = energy measured by the reference device or energy standard.

NOTE: If accuracy verification reveals inaccuracies in your meter, they may be caused by typical sources of test errors. If there are no sources of test errors present, please contact your local Schneider Electric representative.

Related topics

- See "Typical sources of test errors" on page 137 for possible causes of test errors.
- See "Power, energy and power factor" on page 139 for information on how the meter calculates power factor.

Test points

The meter should be tested at full and light loads and at lagging (inductive) power factors to help ensure testing over the entire range of the meter. The test amperage and voltage input rating are labeled on the meter. Refer to the installation sheet or data sheet for your meter's nominal current, voltage and frequency specifications.

Watt-hour test points example

Watt-hour test point	Sample accuracy verification test point
Full load	100% to 200% of the nominal current, 100% of the nominal voltage and nominal frequency at unity power factor or one (1).
Light load	10% of the nominal current, 100% of the nominal voltage and nominal frequency at unity power factor or one (1).
Inductive load (lagging power factor)	100% of the nominal current, 100% of the nominal voltage and nominal frequency at 0.50 lagging power factor (current lagging voltage by 60° phase angle).

Var-hour test points example

Var-hour test point	Sample accuracy verification test point
Full load	100% to 200% of the nominal current, 100% of the nominal voltage and nominal frequency at zero power factor (current lagging voltage by 90° phase angle).
Light load	10% of the nominal current, 100% of the nominal voltage and nominal frequency at zero power factor (current lagging voltage by 90° phase angle).
Inductive load (lagging power factor)	100% of the nominal current, 100% of the nominal voltage and nominal frequency at 0.87 lagging power factor (current lagging voltage by 30° phase angle).

Energy pulsing considerations

The meter's alarm / energy LED and digital outputs are capable of energy pulsing within the following limits:

Energy pulsing limits

Description	Alarm / energy LED	Digital output
Maximum pulse frequency	2.5 kHz	25 Hz
Minimum pulse constant	1 pulse per kWh	
Maximum pulse constant	9,999,999 pulses per kWh	

The pulse rate depends on the voltage, current and PF of the input signal source, the number of phases, and the VT and CT ratios.

If Ptot is the instantaneous power (in kW) and K is the pulse constant (in pulses per kWh), then the pulse period is:

$$\text{Pulse period (in seconds)} = \frac{3600}{K \times Ptot} = \frac{1}{\text{Pulse frequency (Hz)}}$$

VT and CT considerations

The test points are always taken at the secondary side, regardless of whether VTs or CTs are used. Ptot is derived from the values of the voltage and current inputs at the secondary side, and takes into account the VT and CT ratios.

If VTs and CTs are used, you must include their primary and secondary ratings in the equation. For example, in a balanced 3-phase Wye system with VTs and CTs:

$$\text{Ptot} = 3 \times \text{VLN} \times \frac{\text{VT primary}}{\text{VT secondary}} \times I \times \frac{\text{CT primary}}{\text{CT secondary}} \times \text{PF} \times \frac{1\text{ kW}}{1000\text{ W}}$$

Example calculations

A balanced 3-phase Wye system uses 480:120 volt VTs and 100:5 amp CTs. The signals at the secondary side are 119 volts line-to-neutral and 4.99 amps, with a power factor of 0.85. The desired pulse output frequency is 20 Hz (20 pulses per second).

1. Calculate the typical total output power (Ptot):

$$\text{Ptot} = 3 \times 119 \times \frac{480}{120} \times 4.99 \times \frac{100}{5} \times 0.85 \times \frac{1\text{ kW}}{1000\text{ W}} = 121.14\text{ kW}$$

2. Calculate the pulse constant (K):

$$K = \frac{3600 \times (\text{pulse frequency})}{\text{Ptot}} = \frac{3600\text{ second/hour} \times 20\text{ pulses/second}}{121.14\text{ kW}}$$

$$K = 594.4\ \text{pulses/kWh}$$

3. At full load (200% of nominal current = 10 A) and power factor (PF = 1), calculate the maximum total output power (Pmax):

$$\text{Pmax} = 3 \times 119 \times \frac{480}{120} \times 10 \times \frac{100}{5} \times 1 \times \frac{1\text{ kW}}{1000\text{ W}} = 285.6\text{ kW}$$

4. Calculate the maximum output pulse frequency at Pmax:

$$\text{Maximum pulse frequency} = \frac{K \times \text{Pmax}}{3600} = \frac{594.4\text{ pulses/kWh} \times 285.6\text{ kW}}{3600\text{ seconds/hour}}$$

$$\text{Maximum pulse frequency} = 47.2\ \text{pulses/second} = 47.2\text{ Hz}$$

5. Check the maximum pulse frequency against the limits for the LED and digital outputs:

$$47.2\ \text{Hz} \leq \text{LED maximum pulse frequency (83 Hz)}$$

$$47.2\ \text{Hz} > \text{digital output maximum pulse frequency (25 Hz)}$$

NOTE: The maximum pulse frequency is within the limits for LED energy pulsing. However, the maximum pulse frequency is greater than the limits for digital output energy pulsing. Pulse output frequencies greater than 25 Hz will saturate the digital output and cause it to stop pulsing. Therefore in this example, you can only use the LED for energy pulsing.

Adjustments to allow energy pulsing at the digital outputs

If you want to use the digital output, you must reduce the output pulse frequency so it is within the limits.

Using the values from the above example, the maximum pulse constant for the digital output is:

$$Kmax = \frac{3600 \times (\text{digital output maximum pulse frequency})}{Pmax} = \frac{3600 \times 25}{285.6}$$

$$Kmax = 315.13 \text{ pulses per kWh}$$

6. Set the pulse constant (K) to a value below Kmax (for example, 300 pulses/kWh), then calculate the new maximum output pulse frequency at Pmax:

$$\text{New maximum pulse frequency} = \frac{K \times Pmax}{3600} = \frac{300 \text{ pulses/kWh} \times 285.6 \text{ kW}}{3600 \text{ seconds/hour}}$$

$$\text{New maximum pulse frequency} = 23.8 \text{ pulses/second} = 23.8 \text{ Hz}$$

7. Check the new maximum pulse frequency against the limits for the LED and digital outputs:

$$23.8 \text{ Hz} \leq \text{LED maximum pulse frequency (83 Hz)}$$

$$23.8 \text{ Hz} \leq \text{digital output maximum frequency (25 Hz)}$$

As expected, changing K to a value below Kmax allows you to use the digital output for energy pulsing.

8. Follow the procedure in "Energy pulsing" on page 81 to set the pulse constant (K) in the meter.

Typical sources of test errors

If excessive errors are observed during accuracy testing, examine your test setup and test procedures to eliminate typical sources of measurement errors:

- Loose connections of voltage or current circuits, often caused by worn-out contacts or terminals. Inspect terminals of test equipment, cables, test harness and the meter under test.
- Meter ambient temperature is significantly different than 23 °C (73 °F).
- Floating (ungrounded) neutral voltage terminal in any configuration with unbalanced phase voltages.
- Inadequate meter control power, resulting in the meter resetting during the test procedure.
- Ambient light interference or sensitivity issues with the optical sensor.
- Unstable power source causing energy pulsing fluctuations.
- Incorrect test setup: not all phases connected to the reference device or the energy standard. All phases connected to the meter under test should also be connected to the reference meter/standard.
- Moisture (condensing humidity), debris or pollution present in the meter under test.

Chapter 16   Power, energy and power factor

This section describes how the meter interprets and calculates power and power factor.

Power (PQS)

A typical AC electrical system load has both resistive and reactive (inductive or capacitive) components. Resistive loads consume real power (P) and reactive loads consume reactive power (Q).

Apparent power (S) is the vector sum of real power (P) and reactive power (Q):
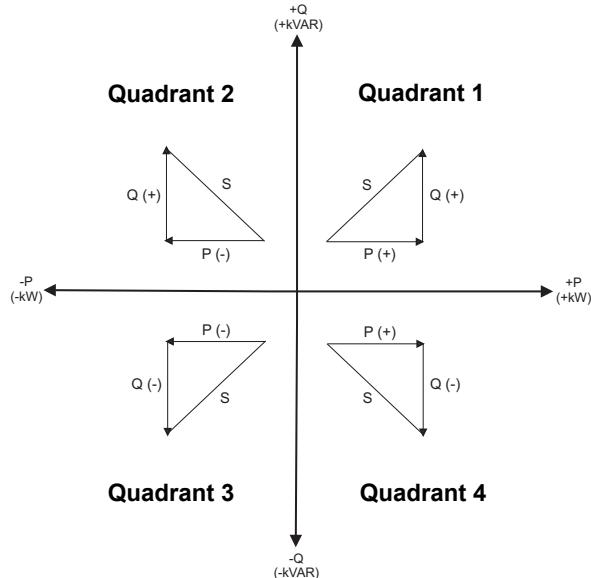
$$S = \sqrt{P^2 + Q^2}$$

Real power is measured in watts (W or kW), reactive power is measured in vars (VAR or kVAR) and apparent power is measured in volt-amps (VA or kVA).

Power and the PQ coordinate system

The meter uses the values of real power (P) and reactive power (Q) on the PQ coordinate system to calculate apparent power.

PQ coordinate system

Power flow

Positive power flow P(+) and Q(+) means power is flowing from the power source towards the load. Negative power flow P(-) and Q(-) means power is flowing from the load towards the power source.

Energy delivered / energy received

The meter interprets energy delivered or received according to the direction of real power (P) flow.

Energy delivered means positive real power flow (+P) and energy received means negative real power flow (-P).

Quadrant	Real (P) power flow	Energy delivered or received
Quadrant 1	Positive (+)	Energy delivered
Quadrant 2	Negative (-)	Energy received
Quadrant 3	Negative (-)	Energy received
Quadrant 4	Positive (+)	Energy delivered

Power factor (PF)

Power factor (PF) is the ratio of real power (P) to apparent power (S), and is a number between 0 and 1.

$$PF = \frac{P}{S}$$

An ideal, purely resistive load has no reactive components, so its power factor is one (PF = 1, or unity power factor). A purely inductive or capacitive load no resistive components, so its power factor is zero (PF = 0).

True PF and displacement PF

The meter supports true power factor and displacement power factor values:

- True power factor includes harmonic content.
- Displacement power factor only considers the fundamental frequency.

PF lead / lag convention

The meter correlates leading power factor (PF lead) or lagging power factor (PF lag) with whether the current waveform is leading or lagging the voltage waveform.
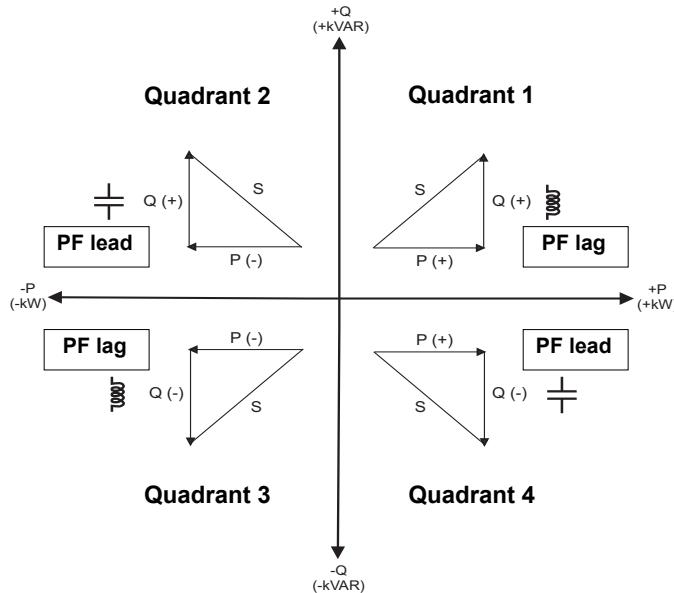
Current phase shift from voltage

For purely resistive loads the current waveform is in phase with the voltage waveform. For capacitive loads, current leads voltage. For inductive loads, current lags voltage.

Current lead / lag and load type

Current and voltage in phase (resistive)	Current leads voltage (capacitive)	Current lags voltage (inductive)
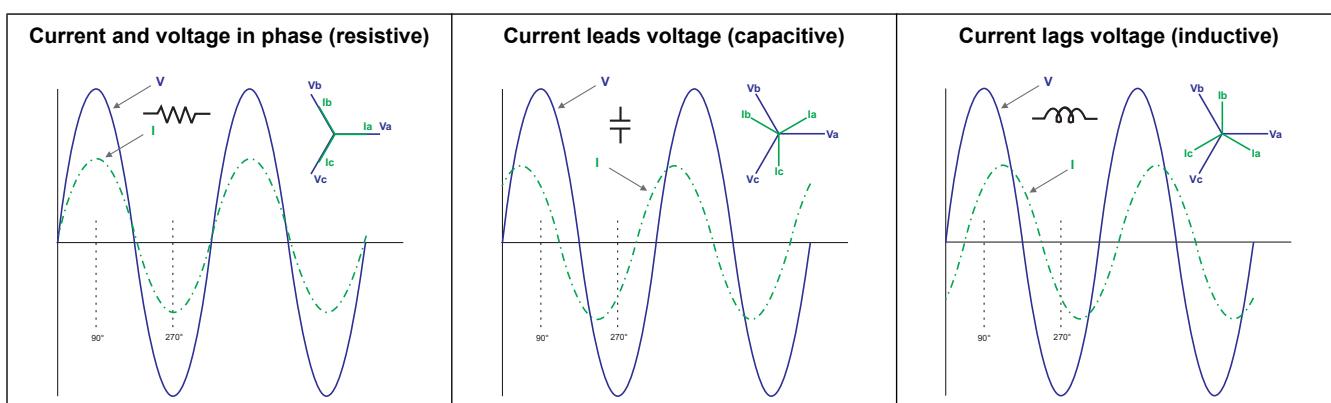
Power and PF lead / lag

PF lead / lag summary

Quadrant	Current phase shift	Load type	PF lead / lag
Quadrant 1	Current lags voltage	Inductive	PF lag
Quadrant 2	Current leads voltage	Capacitive	PF lead
Quadrant 3	Current lags voltage	Inductive	PF lag
Quadrant 4	Current leads voltage	Capacitive	PF lead

PF sign convention

Depending on the regional settings, the meter shows positive or negative power factor according to IEC or IEEE standards.

PF sign in IEC mode

When the regional setting is set to IEC mode, the meter correlates power factor sign (PF sign) with the direction of real power (P) flow.

- For positive real power (+P), the PF sign is positive (+).
- For negative real power (-P), the PF sign is negative (-).

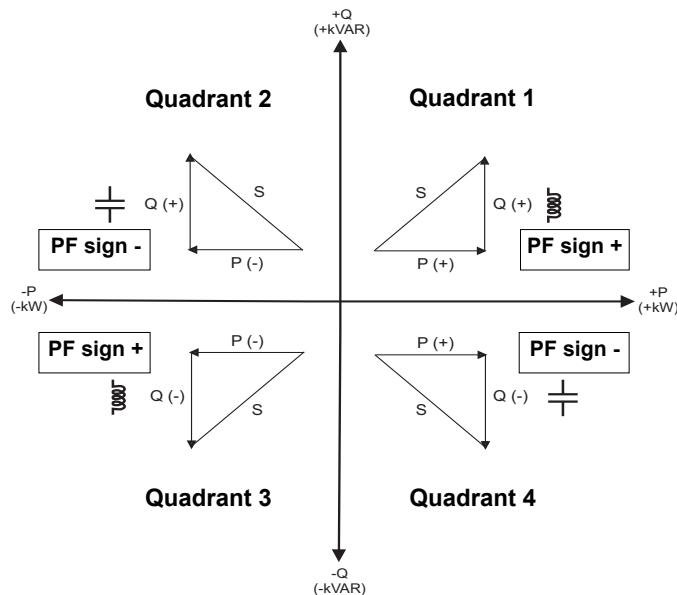**Power factor sign in IEC mode**
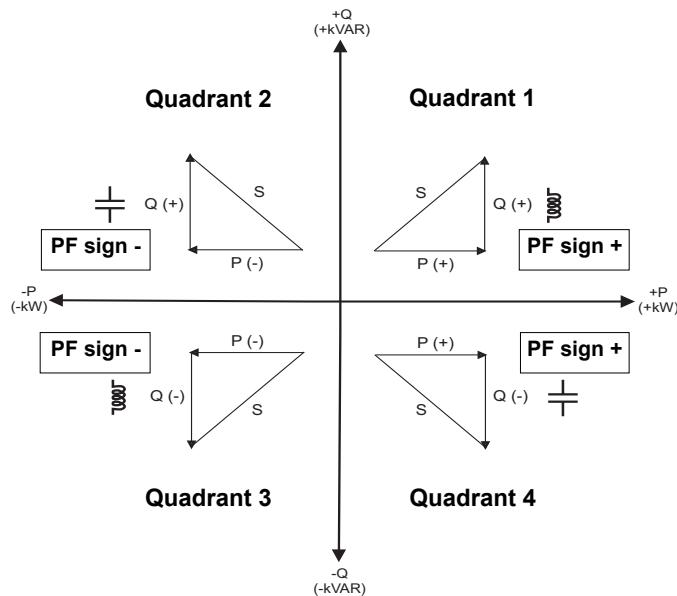
PF sign in IEEE mode

When the regional setting is set to IEEE mode, the meter correlates power factor sign (PF sign) with the PF lead / lag convention (also load type).

- For PF lag (inductive), the PF sign is positive (+)
- For PF lead (capacitive), the PF sign is negative (-).

Power factor sign in IEEE mode

Power factor register format

Each power factor value (PF value) occupies one floating point register for power factor (PF register). The meter performs a simple algorithm to the PF value then stores it in the PF register. The meter and software interpret the PF register for all reporting or data entry fields according to the following diagram:

How PF value is stored in the PF register
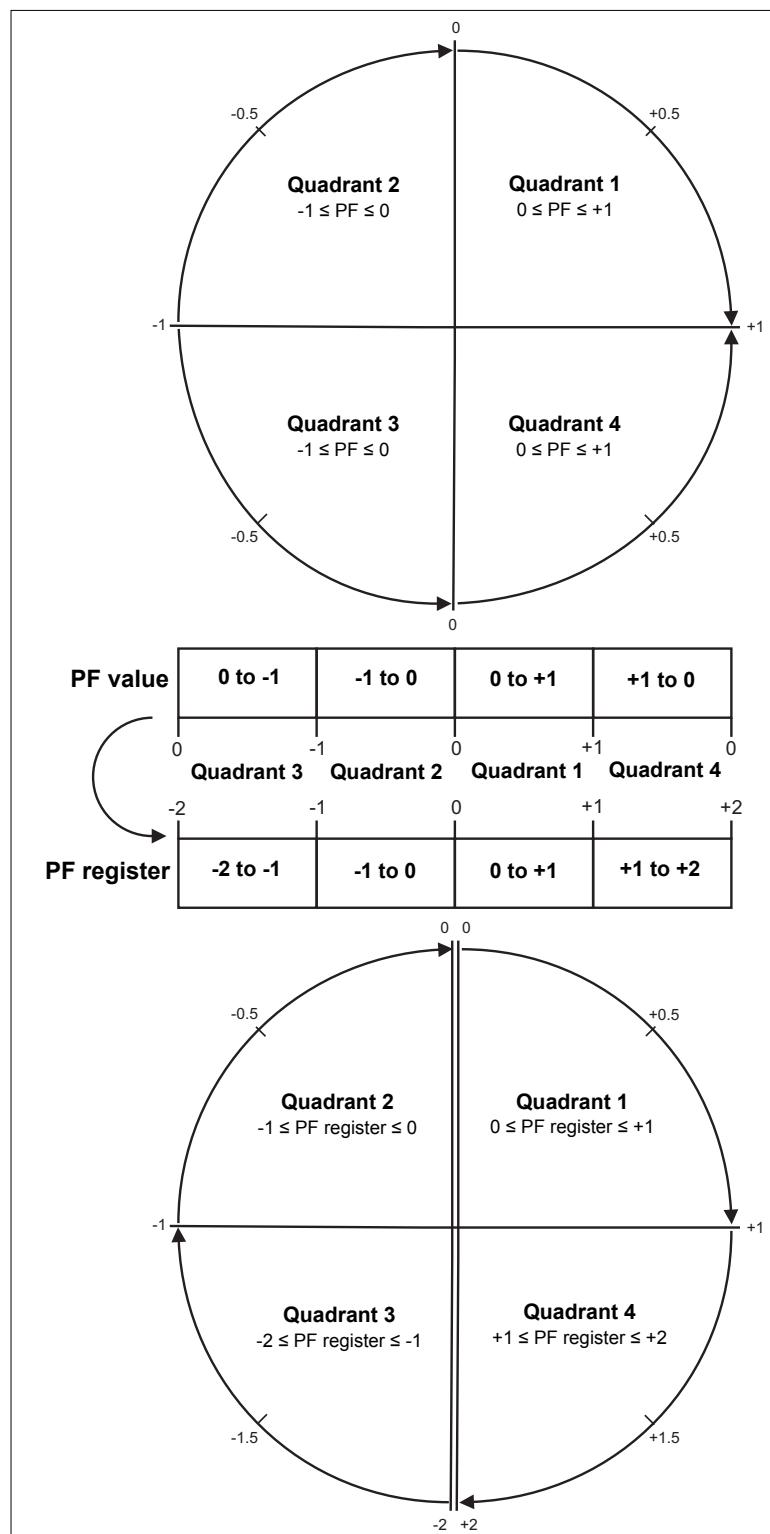
PF value is calculated from the PF register value using the following formulas:

Quadrant	PF range	PF register range	PF formula
Quadrant 1	0 to +1	0 to +1	PF value = PF register value
Quadrant 2	-1 to 0	-1 to 0	PF value = PF register value
Quadrant 3	0 to -1	-2 to -1	PF value = (-2) - (PF register value)
Quadrant 4	+1 to 0	+1 to +2	PF value = (+2) - (PF register value)

PowerLogic™ PM5500
User manual

PowerLogic and Schneider Electric are trademarks or registered trademarks of Schneider Electric in France, the USA and other countries. Other trademarks are the property of their respective owners.

Electrical equipment should be installed, operated, serviced and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material. A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.